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Eighteenth Report

State Entomologist of Minnesota

To the GOVERNOR

By A. G. RUGGLES

Agricultural Experiment Station
University Farm, St. Paul, Minnesota
December 1, 1920

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SUBJECT INDEX

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December 1, 1920

To His Excellency J. A. A. Burnquist,
Governor of the State of Minnesota.

Dear Sir:

In compliance with the law I have the honor to present herewith a report on the activities of the State Entomologist for the year ending December 1, 1920.

Our three funds, the state entomologist fund, the nursery inspection fund, and the special fund for white pine blister rust would indicate that the work is organized along certain very definite lines. As a matter of fact the work as planned this year is very closely knit together. The men in the field, whether in nurseries, on farms, or in the forest, were constantly on the lookout for plant pests, barberries, and a special disease of white pine. Close coöperation was effected with the Division of Plant Pathology and Botany, at University Farm, in the matter of plant diseases and barberry eradication; with the United States Department of Agriculture on barberry eradication and the white pine blister rust survey, and with the state forester on Ribes eradication.

In reporting this work, the principal subjects of interest will be briefly outlined.

Inspection of nurseries.—The nursery business in Minnesota continues to increase. The older firms are enlarging their business and new firms are starting. It must be remembered that all our cultivated flowers, shrubs, and trees come from this source. With the constantly increasing demand for such material it is well to bear in mind the necessity for keeping such stock in a perfect condition. Our department, therefore, is to be regarded as the Health Bureau of the plant industry of the state.

As a rule improved labor conditions were reflected in the appearance of nurseries throughout the state. Inspection this year was extended to include a large number of orchards, special attention being given to those of commercial size. We were able to give helpful information to several orchard owners and we hope that this part of the work can be enlarged next year if sufficient funds are provided. Approximately two hundred twenty-five towns were covered in the inspection of nurseries and orchards. A total of 163 nurseries were inspected, the larger ones being inspected three or four times during the season. Eight deputy inspectors were employed on this work, two of them during only part of the summer.

Altho several minor diseases and insects were found this year, none were of sufficient importance to necessitate withholding a certificate. Several interesting problems in the control of insects and diseases have appeared. It is hoped that some time can be spent next year in trying to solve the most important of these. Our efforts last season in trying to stamp out the white pine blister rust were evidently successful, for altho more time was spent this year than ever before in hunting the disease, it was not found in a single nursery.

The inspection of foreign shipments has been somewhat modified, owing to the strict provisions of the new federal quarantine No. 37, dealing with the entry of foreign-grown nursery stock. As there appears to be a lack of proper inspection by European inspectors, it is imperative that the small amount of material coming into the country must be inspected more carefully than usual at the destination. The value of state quarantines was emphasized this year when it was learned that nine shipments of stock from an area in New Jersey infested with the Gipsy Moth had been sent into this state in 1917. Fortunately no trace of this dangerous insect was found in checking up these shipments.

In 1919 in examining a shipment of about three thousand Narcissus bulbs from Holland, twenty per cent were found infested with the Narcissus fly, *Merodon equestris* Fab. In several bulbs there were found, along with the narcissus fly, larvae which proved to be those of the Lunate onion fly, *Eumerus strigatus* Fall. This is a bad pest in Europe and as it is possible that we were not able to intercept all the infested bulbs, some may have escaped to become a new pest of onions in Minnesota.

The Minnesota quarantine against currants and gooseberries from certain states on account of the white pine blister rust was amended on January 5, 1920, to allow entry of all species except the cultivated black currant. The finding of much blister rust in Minnesota made continuance of this quarantine unnecessary. A quarantine on corn, except shelled corn or shelled corn products, from Massachusetts, New Hampshire, and New York was established March 5, 1920, on account of the presence of the European Corn Borer in those states.

White pine blister rust.—In view of the general distribution of blister rust infection in east central Minnesota as found in 1919, the possibility of its complete or partial eradication from the state was definitely abandoned and a permanent policy of local control adopted. The United States Department of Agriculture, coöperating with us in blister rust control, has found that the removal of all currant and

gooseberry bushes within 200 to 300 yards will protect white pines under usual conditions.

The future development of blister rust control in Minnesota became, therefore, primarily a forestry problem. This situation was immediately brought to the attention of the State Forester and his hearty coöperation was secured. The following program was then outlined for 1920: (1) Control work to be undertaken by the State Forester; (2) scouting in and around nurseries to prevent distribution of blister rust by infected nursery stock and a limited amount of scouting in the native pine area to determine progress of infection, to be carried on by the State Entomologist; (3) educational work to be carried on by the State Forester and State Entomologist co-operating; (4) experimental work, the study of currants and gooseberries in relation to eradication methods, to be undertaken by the chief of the Division of Forestry, Minnesota Agricultural Experiment Station.

Two eradication crews, each composed of five or six men and one foreman, worked all summer protecting pines in state parks and on state lands. The total area covered was 743 acres, work being carried on in the Interstate Park, at Taylor's Falls; in Jay Cook Park, near Carlton; and in Itasca Park. The cost of first-time eradication ranged from $1.70 to $13.74 per acre, averaging $4.69 for the entire area.

Blister rust was found this year over a much wider area than before, isolated infections being found as far north as Tower, in northern St. Louis County; as far east as Knife River, in the southwest corner of Lake County; and as far west as Gull Lake, northwest of Brainerd, in the southeast corner of Cass County. Infection was found for the first time in the counties of Cass, Crow Wing, Itasca, and Lake. Comparatively little time was spent in scouting for disease in the native pine area.

It must now be assumed that blister rust is present in practically any part of the state where white pines are found and the development of future plans governed accordingly. For the next few years a large part of this work should be educational with a view to showing owners of white pine areas the danger from this disease. The protection of nurseries and the state lands by the eradication of the *Ribes* must, of course, be continued.

Barberry eradication.—The barberry campaign was carried on systematically in 1920 by the Office of Cereal Investigations, Bureau of Plant Industry, United States Department of Agriculture. Two men and an automobile were assigned to a county with instructions to ex-

amine every farmstead for the common barberry. Nine counties, Lac Qui Parle, Yellow Medicine, Lincoln, Lyon, Pipestone, Murray, Nobles, Jackson, and Martin, were completely surveyed. While systematic survey was carried on in nine counties, a tenth, Faribault, was almost completed, but work was cut off on account of the weather. Besides this work, nursery inspectors who were working all over the state were always on the alert and reported many bushes. The most of the field work, however, was carried on by the Office of Cereal Investigations, Bureau of Plant Industry, under L. W. Melander, state leader, and under general direction of Dr. E. M. Freeman, of the Division of Plant Pathology and Botany, University Farm. Approximately $10,000 of Federal funds were spent since July 1, 1920, when the campaign for the present year began. Some funds are still on hand so the 1921 campaign will possibly start before May 1.

To date, 729,875 bushes have been found in Minnesota, 729,411 have been dug. Of these, 5,562 bushes were found this year on 223 properties. The bushes on 191 properties have been removed. Thirty-one of these plantings had escaped from cultivation, or, in other words, were wild.

Southeastern Minnesota, particularly along the Mississippi, presents a condition somewhat different from other parts of the state. Here many farms are infested with barberry bushes which have not been planted by the farmer, but seeds have evidently been carried for miles by birds, to sprout and grow into bushes. To remove these bushes costs the farmer a considerable amount of money through no fault of his own, and to enforce the law causes considerable antagonism. An extra man on the job to help the farmer take out these bushes and employed entirely by the state would help this difficulty.

In almost every outbreak of wheat stem rust the source of infection can be traced to the barberry. A farmer in Goodhue county recently said that in 1918 he did not have a bit of stem rust until after a severe northwest wind and rain. The field assistant pointed out an area due northwest of this man's farm where in 1919, 13,000 bushes were destroyed. Spores evidently were carried from this infested area by the wind.

The federal and state departments are working in close coöperation and give each other all the help possible. If this coöperation can continue for five years, with the state helping a little more financially than at present, the survey of Minnesota for barberry will be near completion, and the great majority of bushes will have been removed. However, the danger of bushes escaping from cultivation must not be

forgotten, and a strong force of helpers during the growing season must be kept on the alert. We believe the work should be continued until it is demonstrated beyond doubt that barberry eradication pays.

Insect problems of the year.—The usual pests of the year have been present, some of them more and some less abundant than usual. Some new insects, as the apple maggot, *Rhagoletis pomonella* Walsh, and the asparagus beetle, *Crioceris asparagi* Linn., have made their appearance in the state. These have already caused considerable damage. Other insects found for the first time this year, as some of the bugs and aphids, will probably be heard from later. The new pests are being studied carefully, as well as the whole group representing the bugs and aphids, so that it is hoped any outbreak can be reported on immediately with methods of control.

Apple maggot.—In 1914 when asked by Professor W. C. O'Kane, of New Hampshire, whether the apple maggot was a pest of Minnesota the reply was, that so far Minnesota had experienced no trouble from the insect. Specimens of the fly *Rhagoletis pomonella* Walsh, were in our collection, found in 1898 on Crataegus, but no reports were on record that the insect had damaged cultivated fruit. The first report of injury came in 1918. In 1919 the reports were more numerous and in 1920 the injury done by this insect was very severe. All of the best apple growing areas were affected, which means practically the southern half of the state.

The common hosts of the insect in Minnesota are the common varieties of apples like the Strawberry crab, Wealthy, Malinda, Peerless, Northwestern Greening, and Patten's Greening. Beside the host plants of apples and Crataegus, Dr. H. H. Knight added this year the wolfberry *Symphiocarpos occidentalis* Hook. He found the white berries in August and September greatly infested.

Damage is done by the insect in both the larval or immature stage, and in the adult. The adults are flies, slightly smaller than houseflies and may be distinguished by the peculiar black bands across the wings. They are found flying during the months of July, August and September, most of the eggs probably being laid in July or August. Before egg laying begins the flies may be seen alighting on the surface of the fruits and leaves, rasping the surface with their probosces, eventually swallowing the removed particles. This process does not injure the fruit materially but soon after feeding, egg laying begins. The eggs are thrust through the skin by means of the ovipositor and where each puncture was made there, later, often appears a depression or dimple. The eggs hatch into maggots which eat through the pulp of

the fruit. In the earlier part of the season the infested apples drop, while later apples may be put in storage and the damage not seen until they are brought out for use several months later. The tunnels made by the tiny maggots through the pulp make the apple unfit for use.

There are practically only two ways of combating this insect. One is by picking up the dropped fruits twice a week or oftener during the summer and destroying them, and the other is by spraying.

Sheep, allowed to run in the orchard during certain periods of the season, pick up many of the infested fruits and prevent the further development of the insects in the apples eaten. Poultry, if in sufficient numbers and confined to the orchard, would unquestionably pick up many of the insects as they escape from the fallen fruit to enter the soil.

In spraying to control the pest, the habit of the adult of rasping the surface of the fruit and leaf is taken advantage of. It is found that if there is a layer of poison, as arsenate of lead, on its food the little fly does not notice the difference. The thing necessary to do, therefore, is to spray the food at the time that most of the flies are around. This is in July.

In our regular spraying program we have always recommended three sprayings, (1) when the center bud of the flower cluster begins to show pink, (2) just after the blossoms fall, and (3) from two to three weeks after the second. In ordinary years the second spray is given about June 15. This would bring the third spraying about the first part of July, which would be just right for the first spraying for the apple maggot. Another spraying, the fourth in all, should be given for this pest about the middle of July. The combination spray of arsenate of lead and lime-sulphur should be used in each application.

As this insect has become so abundant and as it is a native American insect "gone bad" and as it is not at all likely that it will lessen its work of destruction, it simply means that the Minnesota orchardist must fight for his crops harder than ever.

Asparagus beetle.—The asparagus beetle, *Crioceris asparagi* Linn., was found for the first time in Minnesota in 1919. The insects were found in one corner of a large asparagus plot in a nursery. Not much damage was noticed in 1919, but in 1920 the asparagus bed was very badly damaged, but the beetle was not found outside a radius of seven miles from the nursery. It looks as if this pest would very soon be added to the number of those with which the home gardener as well as the market gardener will have to contend.

Grasshoppers.—Grasshoppers started last spring in earnest. The

fall of 1919 was very favorable for egg laying, and eggs hatched in enormous numbers in June, 1920. A campaign for grasshopper control was put on in the infested counties and much poison bait was used by the farmers. This fact coupled with the wet June, prevented grasshopper development in Minnesota. Hence only in a few local areas was much damage done.

The dry fall of 1920 was again very favorable for grasshopper egg laying, so the grower must be alive to danger from these pests in 1921. It is hoped that the experience of the last season will help materially in spreading the gospel of control measures.

Cutworms and army worms.—The year 1920 was notable for the absence of the common varieties of cutworms which work in fields and gardens in the spring. Altho there was a widespread and serious outbreak of the Variegated cutworm, in 1919, this species was present only in very small numbers and practically no complaints were received.

There was also an outbreak of the army worm in 1919, which covered a large part of the state. This species was also reported in 1920, altho from an entirely different part of the state. In 1919 the area of greatest abundance covered the northwestern part of the state nearly as far south as the Minnesota River, and another infested region extended from near Duluth to the southern boundary along the Mississippi River. In 1920 the southwestern part of the state, south of the Minnesota River, was attacked, with the centers of heaviest infestation in Yellow Medicine and Lyon counties. Reports of damage were received from practically all the counties west of Mankato and south of the Minnesota River.

Reports came in about ten days later than in 1919, following a cool, wet spring which retarded the growth of the larvae. An interesting feature of the season's work was the failure of the worm to form true marching armies. A visit was made to the infested regions the first week of August, and it was found that in no case had the armies marched more than a few hundred feet. The individual armies were small, but there were sometimes three or four distinct armies, originating from as many centers of infestation in a single field.

The apparent cause of this failure to march was to be found in the weather conditions at the time of egg laying. The latter part of June and the first week of July were very wet, and many favorable places for egg laying could be found in any field. This accounted for the smallness of the armies and their quite uniform distribution over the section. A belt consisting of the northern parts of Cottonwood

and Murray counties, and the southern parts of Lyon and Redwood counties was badly damaged, as was another section lying on the boundary between Pipestone and Rock counties. Isolated outbreaks were reported from Canby, Yellow Medicine county, Hutchinson, McLeod county, and Northfield, Rice county.

The damage was done principally to oats, and consisted in the cutting off of the heads. This was seen to a considerable extent even in fields in which the oats were cut and shocked. In one or two places flax and corn were attacked, and at Northfield a pasture was slightly damaged. Clover and other leguminous crops were rarely eaten, and in no case were they badly damaged. Where oats and wheat were planted together, the oats were always more badly damaged than the wheat.

There is little probability of an attack in this region in 1921, but fall conditions seem to indicate the possibility of an outbreak through the central portion of the state, near the Twin Cities and northward to St. Cloud. This, however, can not be definitely determined until next July.

Onion insects.—The onion maggot and onion thrips were much in evidence last year, particularly the latter. Considerable experimental work was done with these insects but the exceptionally dry summer prevented experimental control work.

Orchard spraying.—The experimental work on orchard spraying was continued and the data are being worked over at this time. The results this year, owing probably to the season, were slightly different from those of last year. This year it was found, as in 1918, that lime-sulphur controlled scab better than any of the other mixtures, while of the arsenicals used, arsenate of lead and arsenate of lime were equally effective in controlling the codling moth or leaf-eating insects. Further experimental spraying work must be carried on before dusting can be unhesitatingly recommended.

Basal leaf galls of cottonwoods, and squirrels.—At the base of cottonwood leaves in June there occurs very often a swollen oval enlargement from a quarter to half an inch in diameter. These are galls caused by a plant louse, *Pemphigus populicaulis* Fitch. Another closely related leaf-stem gall is caused by *Pemphigus populitransversus* Riley. These galls on the leaf stems of cottonwoods are very common in this state. During the early part of the summer complaints came to the office that the cottonwoods were losing their leaves. The same thing was happening on my own lawn. Upon examination of the fallen leaves it was found that they had broken off or had been cut straight across the center of the gall. In freshly fallen leaves the cut areas were still fresh and

green. It seemed very peculiar that the galls should break just at this point when others were still on the tree and needed considerable pull to make them break. An unusually large number of these leaves falling one day made a study of the problem imperative. To make a long story short, a red squirrel *Sciurus hudsonius* Erx., was the depredator. The squirrel would reach for the galls and eating into them, as he would a nut, evidently enjoyed the taste of the enclosed plant lice. The leaf portion became free and dropped. From thirty to forty seconds would suffice for one gall. He went from leaf to leaf with great rapidity. The feasting was kept up for an hour or sometimes longer, until the hunger was satisfied. One squirrel could therefore do considerable damage. Since that time the operation has been seen many times.

In one wood where there were not supposed to be any red squirrels this phenomena of leaf dropping occurred. As our observations did not extend over a long time it could not be proved that squirrels were the depredators. The large gray squirrel, *S. carolinensus* Gon., has never been seen to do the injury.

In connection with the forest insect work it has been shown by experiment that insects working in logs are much more subject to the action of external physical factors than was formerly supposed. Logs in deep shade are apparently less subject to injury by the more serious wood destroyers than those in more open situations. This is partly due to a retarding of the rate of development in the cool, shady location and partly to the fact that fewer eggs are deposited in logs under very shady conditions. This suggests the possibility of shading logs to protect them from the attack of the more injurious species of insects.

On the upper side of logs exposed to the direct rays of the sun, subcortical temperatures of 60 degrees, C., or more have been observed. In fact, in some logs the temperatures on almost any bright day during the summer will pass above the fatal point for insects. This is not, however, true of all logs. The temperature beneath the bark is governed by light intensity, angle of incidence of the sun's rays, color, surface, structure, thickness of the bark, air temperature, air movements, evaporation from bark surface, and proximity to the other radiating or absorbing surfaces. White pine logs often reach very high temperatures, while norway pine logs are comparatively cool.

One of the problems studied during the past year has been the spreading and adherence of arsenical sprays. Considerable progress has been made on both phases of the problem and the details will soon appear in print. Much, however, remains to be studied. From the results of this investigation certain new fields of insecticidal experimen-

tation have been opened up. It is hoped that certain insects which it has hitherto been impossible to destroy by sprays, may be controlled by some of these sprays.

The financial statement and a list of Minnesota nurserymen are appended.

Respectfully submitted,
A. G. Ruggles,
State Entomologist.

FINANCIAL STATEMENT

STATE ENTOMOLOGIST

Fiscal Year, July 1, 1919, to June 30, 1920

Appropriation		$6,300.00
Expenditures		
Salaries	$4,187.89	
Expenses	449.65	
Printing and publishing	319.38	
Office supplies	72.30	
Freight and express	3.06	
Telephone and telegraph	84.41	
Miscellaneous	445.39	
Photos, cuts, and equipment	101.06	
Furniture and equipment	232.67	5,895.81
Balance		$404.19

NURSERY INSPECTION

Fiscal Year July 1, 1919, to June 30, 1920

Appropriation		$5,000.00
Salary refund		150.00
Nursery inspection fees		600.00
Credit on lost badges		5.00
		$5,755.00
Expenditures		
Salaries	$1,504.09	
Traveling expenses	921.63	
Miscellaneous	43.63	
Printing	272.54	
Postage	100.00	
Telephone and telegraph	7.00	
Furniture and equipment	86.06	$2,934.95
Balance		$2,820.05
Collections—nursery fees		
105 Certificates issued to nurserymen	$525.00	
15 Certificates issued to dealers	75.00	
Refund on lost badges	5.00	
Refund on salary check	150.00	$ 755.00

Deposited with State Treasurer		
October 16, 1919	$225.00	
December 3, 1919	205.00	
January 17, 1920	40.00	
March 3, 1920	70.00	
March 9, 1920	5.00	
May 5, 1920	40.00	
June 5, 1920	20.00	
June 25, 1920	150.00	$755 00

WHITE PINE BLISTER RUST

Fiscal Year July 1, 1919, to June 30, 1920

Appropriation	$7,500.00	
Salary refund	150.00	
Refund	1.05	$7,651.05

Expenditures

Overdraft, July 1, 1919	$65.35	
Salaries	3,770.74	
Expenses	2,479.46	
Printing and publishing	285.38	
Supplies	70 70	
Miscellaneous	36.78	
Freight and express	43.97	
Groceries and camp equipment	184 32	
Telephone and telegraph	39.70	
Photos, cuts, etc.	14.05	
Furniture and equipment	469.63	$7,460.08
Balance		$190.97

NURSERIES INSPECTED

1920

Town	Nursery	Proprietor or Address
Aitkin	Carl F. Carlson	
Aitkin	Diamond Trail Nursery	Erickson Brothers
Albert Lea	The Albert Lea Nursery	O. M. Peterson
Albert Lea	Robert H. Black	
Albert Lea	The South Side Nursery	Martin Fridholm
Albert Lea	Harry E. Ruble	
Albert Lea	Wedge Nursery	Robert Wedge
Alexandria	Alexandria Nursery Company	Alex Anderson
Alexandria	Alexandria Fruit Farm	Henry Wille
Annandale	Alexandria Fruit Company	F. J. Eaker
Arago and Cloquet	College of Forestry	State of Minnesota
Askov	Askov Nursery	Ludvig Mosbeck
Atwater	Atwater Fruit Farm	Peter Peterson
Austin	A. N. Kinsman, Inc.	A. N. Kinsman, Inc.
Austin	The Turtle Creek Nursery	J. M. Lindsay
Bagley	The Herschberger Nursery Farm	
Battle Lake	The Swedberg Bros. Nurseries	Swedberg Bros.
Bemidji	J. A. Berglund	
Bemidji	Beltrami Nursery and Greenhouses	Otto Brose
Bemidji	Shady Nook Poultry and Fruit Farm	I. E. Raymond
Buffalo	Wah-wah-taysee Lodge	T. W. Ingersoll
Byron	The Byron Nursery	F. E. Cutting
Cambridge	Oslund's Nursery	N. N. Oslund
Canby	Sivert's Nursery	Peter Sivert
Canton	Fillmore County Nursery	George F. Snyder
Clear River	Dell Revere Fruit and Nursery Co., F. J. Bernard & Sons	
Cloquet	Hagen & Nielson	114 Met. Life Bldg., Minneapolis
Cokato	Cokato Berry Farm	Fayette Lee
Cokato	John Eklof's Nursery	John Eklof
Collegeville	Collegeville Trial Station	St. John's University
Crookston	Crookston Substation	University of Minnesota
Crookston	Schuster Nursery	E. W. Schuster
Crookston	The Vandermark Nursery	Mrs. C. W. Vandermark
Deerwood	Frank Fuller	
Deerwood	G. W. Hunt	
Delano	C. A. Brunkow	
Delano	Delano Nursery	Charles Sell
Dresback	W. S. Widmoyer	
Duluth	Oliver Brown Nursery	Oliver Brown 32 Washington Ave.
Duluth	Duluth Substation	University of Minnesota
Eagle Bend	Eagle Bend Nursery	T. W. Taylor
East Grand Forks	Loudenback Nursery	F. J. Loudenback

TOWN	NURSERY	PROPRIETOR OR ADDRESS
Elmore	Elmore Nursery	Jens Coupanger
Excelsior	Brackett's Nursery	A. Brackett
Excelsior	The Deephaven Nursery	Alfred O. Hawkins
Excelsior	The Highlands Fruit Farm	C. P. Jackson Land Co.
Excelsior	The Hawkinson Nursery	Charles Hawkinson
Excelsior	Minnetonka Old Fashioned Flower Garden	Mrs. N. S. Sawyer
Excelsior	O. H. Seaman's Nursery	O. H. Seaman
Excelsior	Thurmann's Nursery	W. J. C. Thurmann
Excelsior	Zumbra Heights Fruit and Poultry Farm	August Sauter
Fairmont	Amber Lake Nursery	P. C. Christenson
Fairmont	C. H. Harndon	
Fairmont	W. H. Wilken	811 N—North Ave.
Fairmont	Fairmont Nurseries	G. D. McKisson
Faribault	Andrews Nursery Co	Andrews Nursery Co.
Faribault	Brand Nursery Company	A. M. Brand
Faribault	Farmer Seed and Nursery Co	Wm. Kueker
Farwell	Claus Osterberg	
Freeport	Wilwerding's Nursery and Apiary	A. J. Wilwerding
Garden City	Mills Lake Nursery	L. D. Mills
Halstad	Evergreen Nursery	Rev. O. A. Th. Solem
Hamel	Hughardt's Sons Nursery	Hughardt's Sons
Hasty	Wright County Nursery	J. S. Elofson
Houston	Vinegar Hill Nursery	Wm. Sandrock
Howard Lake	Howard Lake and Victor Nurseries	W. H. Eddy
Hubbard	L. I. Grant	
Hubert	Northwestern Plum Nursery	Freeman Thorpe
Hutchinson	Louis Melicker	
Inver Grove	Otto G. Born	
Jeffers	Jeffers Trial Station	Dewain Cook
Kelliher	I. W. Gehron	
Kenyon	The Kenyon Nursery	J. A. Mogren & Sons
Kenyon	The Oak Grove Nursery	P. H. Volstad
Kenyon and Zumbra	South Kenyon Nursery	E. J. Hershaug
Kimberly	Ayres' Jack Pine Nursery	H. B. Ayres
La Crescent	D. C. Webster Fruit Farm	D. C. Webster
Lake City	N. E. Anderson Nursery	N. E. Anderson
Lake City	The Jewell Nursery Company	The Jewell Nursery Co.
Lake City	Underwood Farms	J. M. Underwood
Lake City	National Nursery Company	J. L. Anderson
Lake City	The Tolleson Nursery	G. A. Tolleson
Lake City	Ed Zilgitt	
Lakeland	Mayfield Nurseries	L. L. May & Company
Lakeland	Oak Bluff Farm	H. V. Rodham
Lindstrom	The Chisago Lake Nursery	Ludwig Carlson
Litchfield	The Ferguson Nursery	W. C. Ferguson
Litchfield	Litchfield Nursery	B. E. Anderson
Long Lake	The Daniels Nursery	F. P. Daniels

TOWN	NURSERY	PROPRIETOR OR ADDRESS
Lonsdale	Lonsdale Nursery	J. P. Vikla
Mabel	O. L. Christopherson	
Mabel	R. Spande	
Madison	The Madison Nursery	M. Soholt
Mankato	Mankato Nursery	Zastrow & Smith
Mantorville	Dodge County Nursery	W. E. Fryer
Marietta	Orton Park Nurseries	C. J. Orton
Marshall	Minnesota State Nursery	E. C. Eaker
Medford	Deerfield Nursery Company	F. J. Brady
Medford	The Medford Nursery	Grace Patton Eaton
Mildred	C. B. Finsaas	
Minneapolis	Harry Franklin Baker	1118 West Lake Street
Minneapolis	Bush's Nursery	G. D. Bush, 40th St. & 15th Ave. S.
Minneapolis	Cedar Hill Nursery	C. N. Ruedlinger P. O. St. Louis Park, Box 114
Minneapolis	The Ellison Nursery	F. H. Ellison 55th St. and France Ave. S.
Minneapolis	The Farmer Nursery	E. A. Farmer P. O. Linden Hills Sta., R. No. 2
Minneapolis	Franklin Nursery	A. B. Franklin, P. O Richfield Sta.
Minneapolis	John H. Hirt Nursery	John H. Hirt, 4430 34th Ave. S.
Minneapolis	C. C. Hunter Nursery	C. C. Hunter, 5700 Nicollet Ave.
Minneapolis	Minneapolis Nursery	A. Norlander 4117 Aldrich Ave. S.
Minneapolis	Minneapolis Park Board	Theo. Wirth, Supt. Court House
Minneapolis	The Frederick Perl Nurseries	Frederick Perl McKnight Building
Minneapolis	Rose Hill Nursery	John Hawkins Como and Eustis Aves.
Minneota	Teigland's Nursery	J. L. Teigland
Montevideo	The Variety Fruit Farm	M. Oleson
Monticello	Monticello Nursery	E. C. Bateman
Moorhead	Crescent Fruit Farm	H. E. Brendemuhl
Nemadji	Combercroft Farm and Nurseries	Geo. E. McComber
Nevis	Nevis Fruit Breeding Station	Jas. Arrowood
Newport	The Bailey Nursery	J. V. Bailey
New Ulm	Pioneer Nursery Company	Wm. Pfaender, Jr.
Nisswa	Lundborg Bros. Nursery	Lundborg Bros.
Olivia	Dunsmore Nursery	Henry Dunsmore
Onamia	Rose Lawn Nursery	Oliver Wyse
Owatonna	The Clinton Falls Nursery Co.	Thos. E. Cashman
Owatonna	The Mitchell Nursery	D. M. Mitchell
Owatonna	Owatonna Nursery Company	L. J. Wesely
Paynesville	The Elmwood Select Nursery	Frank Brown & Son
Pequot	Ole Brunes	
Preston	The Preston Nursery	C. E. Snyder
Princeton	Silver Lake Plant Farm	Herman J. Lowell

TOWN	NURSERY	PROPRIETOR OR ADDRESS
Princeton	J. O. Runsten	
Rockford	Lake Sarah Special Farm	F. C. Erchel
St. James	The St. James Nursery and Greenhouse	J. J. Hill
St. Joseph	Matthew Reisinger Nursery	Matthew Reisinger
St. Paul	E. C. Amundson Nursery	E. C. Amundson 1960 E. Minnehaha
St. Paul	J. C. B. Andersson Nursery	J. C. B. Andersson 1285 Portland Ave.
St. Paul	Department of Parks and Playgrounds	J. M. Clancy, Comr., Court House
St. Paul	Hoyt Nursery Company	W. T. March Hoyt and Hamline Aves.
St. Paul	Capitol City Nurseries	1511 Raymond Ave.
St. Paul	Killmer-Brady Northern Nurseries	E. C. Killmer and B. H. Brady
St. Paul	The Park Nurseries	Holm & Olson, Inc.
St. Paul	Rainbow Gardens	John E. and Grace Crooks 1918 Montreal Ave.
St. Paul	Riverview Gardens	A. J. Wilkus, 909 Winslow Ave.
St. Paul	F. C. Schletty	P. O. Daytons Bluff Station
St. Peter and Winthrop.	Nicollet and Sibley County Nurseries	C. Edwin Swenson
Sacred Heart	Sacred Heart Nursery	J. Flagstad & Sons
Spring Valley	Spring Valley Nursery	Frank Waskosky
Starbuck	Minnewaska Nursery	Paul P. Klevann
Taylors Falls	Strand's Nursery	G. W. Strand
Tyler	The Tyler Nursery	J. P. Eriksen
Vergas	E. L. Thomas	
Waltham	Maplehurst Nursery	Grace E. Kimball
Wayzata	Ferodowill Nurseries	F. X. Ferodowill
Wayzata	The Minnetonka Nursery	Douglas Winter
Wells	Orchard Hill Fruit Farm	R. L. H. Lord
West Concord	West Concord Nursery	Fred J. Cowles
White Bear	A. E. Hooker	
White Bear	D. W. C. Ruff	
Willmar	S. E. Magnusson	
Winnebago	The S. D. Richardson Nursery	S. D. Richardson
Winnebago	The Winnebago Nursery	W. P. Wallace
Winona	The Pfeiffer Nursery	C. A. Pfeiffer & Son
Zumbra Heights P. O. Excelsior	University Fruit-breeding Farm, University of Minnesota	
Faribault	Northern Farmers Nursery Co	John S. Brand
Fairmont	F. M. Clough	
Fairmont	Duluth Floral Company	121 W. Superior St.
Duluth	North Star Farm	J. W. Beckman

TOWN	NURSERY	PROPRIETOR OR ADDRESS
Glenville	Floral Mound Nursery	J. J. Peterson
Litchfield	F. E. Amundson	
Mankato	M. M. Sinotte	
Minneapolis	Armstrong Seed Company	2d Ave. and 7th Street
Minneapolis	The Johnson Nursery	3300 Elliot Ave. S.
Minneapolis	Emma V. White Company, Inc.	3010 Aldrich Ave. S.
Minneapolis	Northrup King & Company	1st St. and Hennepin Ave.
St. Cloud	The St. Cloud Nursery Company	F. A. Ward, Mgr.
St. Paul	Emporium Mercantile Company	7th and Robert Sts.
St. Paul	R. L. Gould & Company	496-502 Jackson St.

OBSERVATIONS ON MITES INFESTING FLOUR AND MILL FEED[1]

By R. N. Chapman

Mites belonging to the family Tyroglyphidae have been well-known pests of flour, grain, and other food products since early in the eighteenth century. They were reported as very numerous in Milwaukee in 1885.[2] When present they are often very numerous, sometimes causing the so called "grocers itch" which is said to be due to mites accidentally getting on the hands of those who handle infested groceries. From the fact that some of these pests have been found infesting cheese in large numbers, they are often called "cheese mites" but it would seem more appropriate to speak of them as "flour mites."

These mites seem to be well fitted for life in stored food products and for distribution in commerce. They have evidently been distributed all over the globe wherever there is trading in wheat, flour, dried meats, dried vegetables, and other similar products. They are doubtless much more prevalent than we ordinarily believe, for their presence is often overlooked because of their small size; and the damage which they do is often ascribed to some other cause.

Within recent years a considerable amount of work has been done on mites in England. This work began during the war and was directed principally toward the damage to wheat and flour. Our knowledge of the habits of these pests has been materially enlarged by this work which has tended to show that mites are restricted to flour and feed with a moisture content of more than eleven per cent. The use of heat and hermetical sealing have also been suggested as means of control and the laboratory experiments with these means have shown that such methods are promising.

In 1920 it was found that mites were very common in flour and feed mills which were examined for them. Dr. Ewing examined some of the specimens obtained and pronounced them species of Tyrolglyphus. In only two cases did the proprietors of the mills realize that the mites were present. In one case a large amount of bran had been spoiled and it had been thought that it was due to "heating." A careful exam-

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1 Published with the approval of the Director as Paper No. 254, of the Journal Series of the Minnesota Agricultural Experiment Station.

2 Riley, 1888.

ination revealed the fact that it was heavily infested with mites which increased the moisture content of the material and probably contributed to the "heating."

The small size of mites and their habits of life make them difficult to combat. The females usually lay from twenty to thirty eggs, altho there is reason to suspect that they sometimes lay many more. The eggs are scattered about in the food and are small oval iridescent structures which sometimes adhere to particles of flour and at other times are entirely free. Their period of incubation varies from three or four days to several weeks depending upon temperature and other factors.

The larval stage lasts for five or more days and the nymphal stage for six or more days depending upon the variable environmental factors. Thus the entire life cycle may be shortened to about seventeen or eighteen days under the most favorable conditions of high temperature and humidity.

The life cycle does not always proceed uninterruptedly as outlined above, for there is often a hypopial or resting stage. In this stage the structure is slightly altered in that the chitinous covering is thick and suckers are present by means of which the mite may be attached to insects or mice for transportation to new and favorable environment. During this stage as well as in short periods at the close of the larval and nymphal periods the mites may be blown about with dust.

When the mites are present in large numbers they often devour practically all of the material so that the result is a mass of mites together with their molted skins. In a warehouse where sacks of cotton-seed cake were stored, the mites were found in piles beside the sacks. By continually falling to the floor a pile of mites had accumulated four inches in height. From this they were crawling away in every direction. Upon the basis of averages of the number of mites in five sample areas two inches square, it was found that there were 64 mites to the square foot at a point three feet from the base of the pile of cotton-seed cake, 32 to the square foot four feet from the pile, and 8 to the square foot six feet from the pile. Beyond this point the floor was of dirt and it was impossible to determine the number of mites.

Laboratory observations on five mites showed that they were capable of crawling, on an average, two inches a minute. This, taken with the observations in the warehouses, makes it evident that mites can crawl from one consignment of goods to another while they are in the warehouse.

The food list of Tyroglyphus contains nearly all food products

made from plant and animal matter, as dried meats, cheese, dried fruits, grain, flour, and many other substances, including sugar. There would seem to be a reasonable doubt as to whether sugar is really the food of the mites in which they actually grow and reproduce, or whether they have been found in it by accident.

The moisture conditions of the infested material, as has already been stated, may often be the limiting factor in the development and reproduction of the mites. However, they may spend long periods in the hypopial stage in which they can endure dessication. This was strikingly illustrated in a cotton-seed meal warehouse where the meal with various moisture contents was blended, with the result that the mixture had a uniform moisture content of less than eleven per cent. Samples taken from certain car lots of meal with a high moisture content showed mites to be present in fairly large numbers, yet twenty samples taken from the blended meal in various parts of the warehouse failed to reveal a single mite. Later a pile of the meal which had accumulated below a conveyor through which the blended meal was removed from the warehouse, was literally alive with mites after it had been moistened by a rain. From this it seems evident that there were mites present in the warehouse in the hypopial stage but that they did not have sufficient moisture to support them in an active stage until they accumulated on the ground under the conveyor.

In examining carloads of bran, middlings, and other feed, it was found that the best procedure was to find a spot where the feed had become damp because of a leak in the roof and examine some of this material. If mites were present at all they would be active in such a place as this. If they were not found in the damp feed, the chances were that the material was free from mites.

In a large percentage of the mills, mites were found when a careful examination was made of the elevator boots and other places which were slightly damp. The best method of examination was to smooth out the surface of the sample with a spatula and examine it carefully with a binocular microscope. Within a few minutes the slow clumsy movement of the mites was evident. When they were present in large numbers a characteristic sweetish odor was evident. When one becomes accustomed to this he can detect the presence of a bad infestation of mites by his sense of smell alone.

It has been stated[3] that certain predatory mites (Chelytes and Parasitus) will entirely eliminate the tyroglyphid mites. However, the

[3] Riley, 1888.

work carried on in England[4] does not seem to substantiate this. The observations of the writers have shown that while these predaceous mites do actually destroy some of the tyroglyphids, their effect is most noticeable when the moisture conditions are unfavorable for the tyroglyphids and the effect is least noticeable when conditions are most favorable. This is indicated by the fact that when hundreds of samples were examined the predaceous mites were most abundant in the dryer material where the tyroglyphids were fewer and the tyroglyphids were most abundant in the moist samples where the predaceous mites were least abundant or entirely absent. In no case, either in the laboratory breeding experiments or in the mills, were the tyroglyphids entirely eliminated by the predaceous mites if the moisture was favorable for the tyroglyphids.

The damage done to flour and grain is evidently due partly to the presence of the mites themselves and partly to bacterial action which may be started by the accumulation of their excrement. Beattie[5] concluded that this was the case in flour which he examined. Humphries[6] concluded that flour could be reconditioned by passing it through a No. 14 bolting cloth, and that if the moisture content was low this flour would be suitable for human food.

Much of the material examined by the author was found to have the characteristic mite odor so strong that it seemed impossible to recondition it and use it for food. In fact much of the stock feed which was badly infested was refused by cattle, evidently because of the odor.

Experiments in separating the mites from flour have shown that adults may be removed by passing the material through a No. 0 standard bolting cloth. To remove the young larvae a No. 9 cloth must be used, and for the eggs a No. 14 cloth. As the presence of adult mites is circumstantial evidence of the presence of eggs, it is not practical to try to get the mites out of any material except that which can be passed through a No. 14 standard bolting cloth. This means that high-grade wheat flour is the only material that can be treated in this way.

Methods of Combating Mites

It is generally said that fumigation is not effective against mites owing to their lack of tracheae. Experiments carried out with carbon

4 Newstead and Duvall 1918, p. 11.
5 Beattie, 1918.
6 Humphries, 1918.

disulphide in elevator boots showed that when seven pounds of carbon disulphide was used to one thousand feet of space most of the mites were killed, but wherever they were in cracks or under several inches of feed some of them survived.

Several commercial sprays used were effective when actual contact was made with the mites. Mites completely covered with crude oil for twenty-four hours were still living. An emulsion of from 15 to 20 per cent crude carbolic oil held in suspension by a 0.1 per cent soap solution was found to be a very efficient contact insecticide and was used as a spray in corners, on floors, under elevator boots, and in freight cars. The odor of this spray is objectionable but if it does not come in contact with the flour or feed it does not seem to impart a permanent odor to the material.

Temperature was found to be very effective for the control of the mites. In laboratory experiments it was found that it was possible to kill them by raising the temperature from 20 degrees to 48 degrees C. in five minutes. At the end of the experiment one per cent of the mites survived, but twenty-four hours later all were dead. When the temperature was raised to 80 degrees there were absolutely no survivals for even the shortest time.

In conclusion, it would seem that mites are now so generally distributed in commerce that it is almost impossible for any establishment to escape infestation if it is taking an active part in the interchange of milled products. The method of preventing a general outbreak of these pests would seem to be to keep the place perfectly clean, permitting no accumulations of flour and other material.

The storage of large quantities of flour, feed, or other susceptible material should be undertaken only in clean dry places and then only when the moisture content of the material is below 11 per cent.

Mills or warehouses which are known to be infested should be thoroly cleaned and all the refuse burned. If it is possible to heat the building to a temperature of at least 120 degrees F. for several hours, this is the best method of eliminating the mites. If the place is not tight enough for heating, the floor and all cracks should be sprayed with a 15 or 20 per cent carbolic oil emulsion.

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FACTORS INFLUENCING THE SUBCORTICAL TEMPERATURES OF LOGS[1]

By S. A. Graham

It has long been a matter of common observation among students of xylophagous insects, particularly among those interested in bark beetles, that the rate of insect development in logs varies greatly in different situations. We find frequent references to "heat prostration" of beetles in thin-barked logs exposed to the sun. Likewise it has often been noted that the time of brood emergence may vary by several weeks between north and south exposures in the same locality. Moreover it is well known that in the North a species may have but one generation during a season, while in the South the same species may have two or more generations. While this is, perhaps, best exemplified by cambium dwellers the same may also be applied to all insects in the log.

These well-known facts indicate rather conclusively that the activities of insects in logs are strongly influenced by the external factors of their environment. Little can be found in literature regarding the action of these factors as a whole, or their comparative influence upon the insects beneath the bark. The most extensive piece of work contributing to the solution of this problem is that of Hennings, who conducted experiments with *Ips typographus* Linn. under controlled temperature and moisture conditions. Unfortunately his work is based only upon air temperature and air humidity, which, as will be shown later, have only an indirect influence upon conditions within the log. Thus Hennings observed "heat paralysis" at an air temperature of 24 degrees C., but the temperature within the log at that particular time can only be a matter of conjecture. Undoubtedly it was much higher. Hennings also noted that changes in the relative humidity of the surrounding air influenced the rate of development and also appeared to influence the fatal temperature of the insects under the bark. Here again he was dealing with an important factor, but in an indirect way.

Other factors than temperature and humidity undoubtedly play an important role in the life of these insects. Hennings, Swaine, and

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others have pointed out that in addition to the heating effect of sunlight a certain stimulation from the action of the solar radiation may be observed. The evaporating power of the air, air movements, atmospheric pressure, and precipitation must all play a part in the life of all xylophagous species.

This article, which is a part of a more extensive piece of work dealing with the ecology of wood-boring insects, will only consider those factors influencing the subcortical temperature of logs. The data for this paper were collected during the summer of 1920 at the field station of the University of Minnesota Forest School, Itasca Park, Minn. The prosecution of the work was materially aided by the laboratory and other facilities provided by the School of Forestry, and by helpful suggestions and criticisms by members of the University Staff, particularly Dr. R. N. Chapman, under whose direction the work was carried on.

FACTORS INFLUENCING TEMPERATURE

The attention of entomologists has recently been called to a practical application of solar radiation in the control of wood-boring insects. Craighead,[2] working with ash logs in several localities in the South, found that the upper side of logs lying in full sunlight often reached a temperature above a point fatal to insects. On the basis of these findings he recommends the weekly turning of logs in order to protect them from destructive wood borers. He observed temperatures under the bark of logs which exceeded air temperature by as much as 60 degrees (F.?) depending upon the locality, the condition of the sky, and the angle of the sun's rays. He does not mention several other factors which, from the experiments upon which the present paper is based, appear to be extremely important, namely: color, structure, thickness, and surface of the bark, air movements, evaporation from the surface layers of the bark, and proximity to other absorbing or radiating surfaces.

The principal factors influencing cambium temperatures may be summarized as follows:

1. Solar radiation
    a. Light intensity
    b. Solar altitude
    c. Angle of incidence

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2 Craighead, F. C., (1920) Direct Sunlight as a Factor in Forest Insect Control. Proc. of the Ent. Soc. of Washington, Vol. 22, pp. 106-108.

2. Character of bark
    a. Color
    b. Surface
    c. Structure
    d. Thickness
3. Air temperature
4. Air movement
5. Evaporation from bark surfaces
6. Proximity to other radiating or absorbing surfaces

EXPERIMENTAL METHODS

Mercury incubator thermometers were used for taking temperatures in the cambium. These were inserted in a hole bored into the end of the log in such a way that the thermometer bulb was located just beneath the bark, about four inches from the end of the log. The expanded portion of the thermometer fitted tightly, thus securely closing the hole in the end of the log. In order to minimize the conduction of heat to and from the log the exposed ends of the thermometers were enclosed in caps. These caps were made of short pieces of unbarked white birch with the center bored out to fit the thermometer. It was later found that these precautions for eliminating conduction were not really necessary since comparable results were obtained by the use of the common type of laboratory thermometer unprotected by caps. The conduction of heat was more rapid through the bark than through the glass of the thermometer. This might not be true of logs with very heavy scaly bark.

The intensity of solar radiation was measured by the comparison of a black and a white bulb thermometer, mounted side by side. The difference in temperature registered by these thermometers varied with the intensity of light. The greatest difference observed during the summer was taken arbitrarily as 100 per cent light and the observations in this paper are percentages of this standard.

Unless otherwise stated the term air temperature as used here refers to the temperature in the open as registered by a white bulb thermometer.

Five species of logs were used in this series of experiments. These were: 1. White pine, *Pinus strobus* Linn.; 2. Norway pine, *Pinus resinosa* Aiton: 3. Jack pine, *Pinus banksiana* Lambert; 4. Black spruce, *Picea mariana* Britton, Sterns and Poggenberg; Balsam fir, *Abies balsamea* Miller. Each species was placed under four different

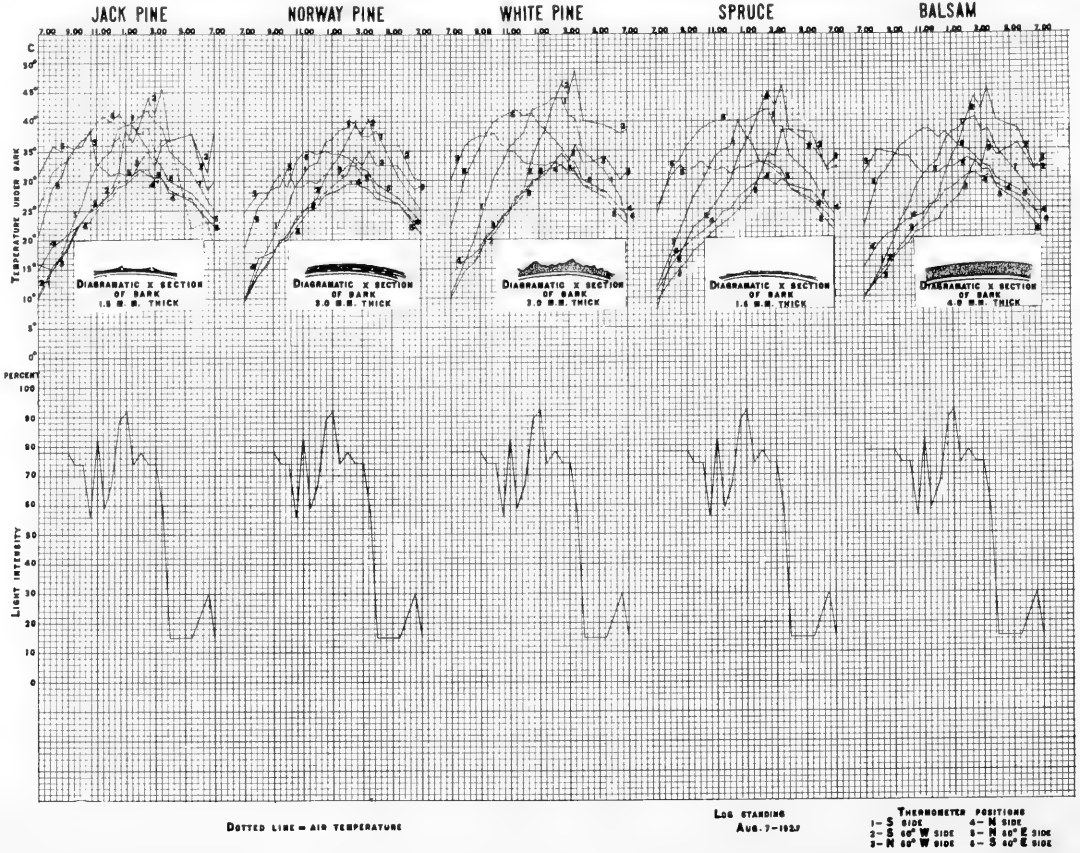
JACK PINE
NORWAY PINE
WHITE PINE
SPRUCE
BALSAM
TEMPERATURE UNDER BARK
PERCENT
LIGHT INTENSITY
DIAGRAMATIC X SECTION OF BARK 1.5 M.M. THICK
DIAGRAMATIC X SECTION OF BARK 3.0 M.M. THICK
DIAGRAMATIC X SECTION OF BARK 3.0 M.M. THICK
DIAGRAMATIC X SECTION OF BARK 1.5 M.M. THICK
DIAGRAMATIC X SECTION OF BARK 4.0 M.M. THICK
DOTTED LINE = AIR TEMPERATURE
LOG STANDING AUG. 7-1927
THERMOMETER POSITIONS
1 - S SIDE
2 - S 60° W SIDE
3 - N 60° W SIDE
4 - N SIDE
5 - N 60° E SIDE
6 - S 60° E SIDE

Plate I.

light conditions, varying from one-quarter to full sun, thus making possible a comparison between the different species under varying conditions. The shades were constructed of lath so spaced as to cut down the direct solar radiation three quarters, one half, and one third, respectively.

All of these logs were lying north and south with the north end slightly raised. Temperatures were taken three times a day on the upper and lower sides of certain logs under each light condition.

In addition, the progression of temperatures around logs of the different species lying in different directions was observed, using six thermometers to a log. The details of this experiment will be discussed later.

EXTREMES OF TEMPERATURE OBSERVED UNDER THE BARK OF LOGS

The primary usefulness of the bark on a tree is apparently to check evaporation from the growing tissues. In addition to this function it has generally been conceded that the bark, being a fairly good non-conductor of heat, also serves the purpose of protecting the tissues beneath from extremes of temperature. This is undoubtedly true in certain cases, for example, with thick scaly bark, but the temperatures observed under moderately thin bark in the course of the present work force us to modify this conception decidedly. In fact, in most cases the heat of the sun was absorbed so rapidly by the bark that the subcortical region showed temperatures so high as to be almost unbelievable. For example, on July 3, which was a very bright day, the temperature beneath the bark on the upper side of a white pine log was 60 degrees C. at 1 p. m., while air temperature was 40 degrees C. This is of course far above the fatal temperature known for any insect. The bark of this log was 5 mm. thick with a rough dark surface. Several times during the summer the difference between the air and the subcortical temperatures of white pine exceeded 20 degrees C., while a difference of 15 to 20 degrees C. was a common occurrence. So great a difference was not true of all species, as will be shown later.

Short exposures to a temperature of 48 degrees C. are fatal to most insects. Experimental evidence indicates that a somewhat lower temperature is fatal to certain bark beetles, while *Chrysobothris* is able to endure temperatures slightly above 50 degrees C. for a short time. Thus the temperature fatal to insects varies considerably with the species. During June there was a considerable amount of cool cloudy weather.

TABLE I

Distribution of Temperature for June, July, and August in per cent of days.

	June						July						August					
	Sun			White pine			Sun			White pine			Sun			White pine		
Degrees C above	White pine 5 mm. bark	Norway pine 2 mm. bark	Norway pine 10 mm. bark	1/3 shade	1/2 shade	3/4 shade	White pine 5 mm. bark	Norway pine 2 mm. bark	Norway pine 10 mm. bark	1/3 shade	1/2 shade	3/4 shade	White pine 5 mm. bark	Norway pine 2 mm. bark	Norway pine 10 mm. bark	1/3 shade	1/2 shade	3/4 shade
15.....	95	100	100	90	95	95	100	100	100	96	100	92	94	100	100	89	95	89
20.....	..	95	90	..	..	40	96	92	89	92	92	58	89	..	83	..	89	72
25.....	90	80	50	80	70	5	..	85	81	85	85	15	..	..	72	..	..	45
30.....	75	65	50	70	65	5	92	77	54	81	69	4	..	..	..	84	78	0
35	..	..	0	..	..	0	..	73	50	..	65	..	..	..	66	..	66	..
37.....	70	60	..	..	55	..	89	69	45	..	..	0	..	90	..	78	..	..
38.....	..	35	..	..	45	..	..	62	..	..	54	..	..	80	..	..	..	..
39.....	..	10	..	..	15	..	..	..	20	73	42	..	..	..	56	72	..	..
40.....	..	..	.	65	10	..	..	54	8	72	..	..	..	..	39	..	56	..
41	65	..	..	..	5	..	..	47	..	58	35	..	..	..	28	61	45	..
42.....	..	..	..	55	5	..	85	42	0	..	19	..	78	..	17	..	28	..
43	..	5	..	40	0	..	..	39	..	54	12	..	..	60	6	..	..	..
44.....	45	0	..	30	..	..	81	19	..	..	8	..	..	..	..	50	17	..
45.....	40	..	..	23	..	..	77	12	..	50	..	..	..	40	..	..	11	..
46.....	30	..	..	15	..	..	73	4	..	42	4	..	67	20	0	39	6	..
47.....	25	..	..	10	..	..	65	..	..	39	..	..	..	10	..	28	..	..
48.....	15	..	..	..	..	..	62	0	..	31	..	..	62	..	..	..	0	..
49.....	..	..	..	5	..	..	..	..	..	..	0	..	..	0	..	23	..	..
50.....	10	..	..	..	..	..	..	..	..	19	..	..	50	..	..	..	..	..
51.....	5	..	..	..	..	..	58	..	..	..	..	..	..	..	..	12	..	..
52.....	0	..	..	0	..	..	42	..	..	16	..	..	44	..	..	0	..	..
53.....	..	..	..	..	..	..	8	..	..	0	..	..	23	..	..	..	..	..
55	..	..	..	..	..	..	0	..	..	..	..	..	6	..	..	..	..	.
60.....	..	..	..	..	..	..	..	..	..	..	..		0	..	..	..	..	..

On 15 per cent of the days the temperature under the rough bark of white pine exceeded 48 degrees C. Under norway pine bark 2 mm. thick, the temperature did not exceed 44 degrees C., while under bark 10 mm. thick the temperature did not exceed 35 degrees C. July and August were much dryer, and during these months on 62 per cent of the days the temperature in rough barked white pine exceeded 48 degrees C. Thin-barked norway pine reached 48 degrees C. a few times, but norway pine with bark 10 mm. thick at no time exceeded 46 degrees C. Except in the early morning it was very unusual to find the temperature under the bark lower than that of the surrounding air.

INFLUENCE OF THE POSITION OF THE LOG WITH REFERENCE TO THE SUN'S RAYS

The temperatures beneath the bark vary greatly in similar logs lying in different positions. A log standing on end will never become heated to as high a temperature as a similar log lying on the ground. Also the action of air currents coupled with the fact that the surface of the log is at a distance from other radiating or absorbing surfaces causes the subcortical temperature of the standing log to be very variable, showing decided fluctuations over short periods of time. (See Plate I.) The log lying on the ground does not show these fluctuations in temperature to any marked degree, but the temperature rises and falls evenly.

In a log lying in a north and south direction a much larger portion reaches a high temperature on a bright day than in a log lying east and west. This is due to the fact that the direct rays of the sun strike only a comparatively narrow strip along the south side of the log lying east and west, while the log lying north and south is heated first on one side and then on the other as the sun moves across the sky. Thus almost half of the log lying north and south may pass above the fatal temperature for insects, while only a quarter or even less of the log lying east and west will reach this temperature. As a rule, however, the comparatively narrow strip on the log lying east and west may reach a higher temperature than any part of the log lying north and south, owing to the greater length of time that each point on this strip is exposed to direct sunlight. (See Plates II and III.)

The rate of conduction of heat around the log varies somewhat with the different species and is apparently partially correlated with

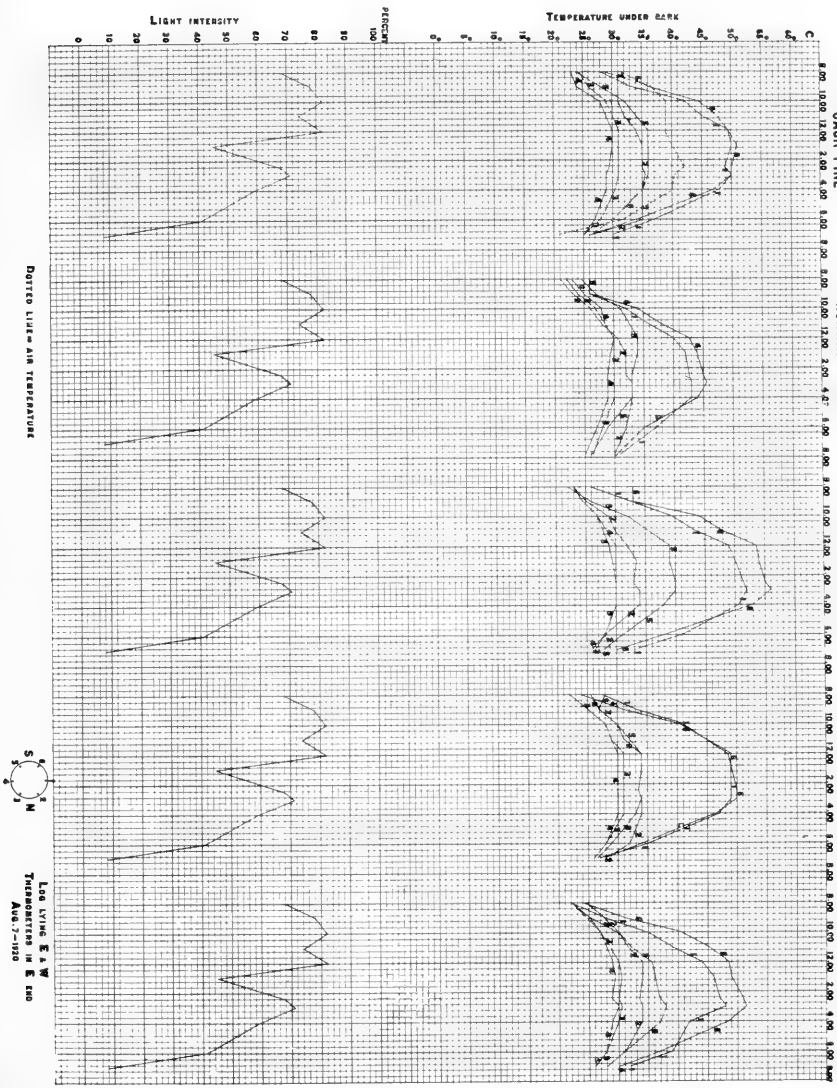
JACK PINE
NORWAY PINE
WHITE PINE
SPRUCE
BALSAM
TEMPERATURE UNDER BARK
LIGHT INTENSITY
PERCENT
DOTTED LINE= AIR TEMPERATURE
LOG LYING E & W
THERMOMETERS IN E END
AUG. 7-1920

Plate II.

the density of the wood. For example, heat is conducted around a balsam log somewhat more rapidly than around a spruce log. The slower this conduction, the sharper the line separating the areas of high and low temperature. This point is graphically illustrated in Plate II. This division line is often so sharp that there may be a difference of more than a degree, C., for each centimeter of circumference along this line. It is perfectly possible for a good-sized Cerambycid or Buprestid larva, lying transversely beneath the bark, to have one part of its body in an area where favorable conditions of temperature exist while another part may be exposed to extreme conditions. Bark beetles such as *Pityokteines sparsus* Lec., which construct transverse egg galleries, are able to avoid extreme temperatures to some extent by moving from one part of the gallery to another. The larvae are, of course, unable to change their positions quickly in this way, and so must endure existing temperatures or perish. Thus it is that we may find completed egg galleries in an area where larval development is impossible.

EFFECT OF SOLAR RADIATION

The effect of the intensity of solar radiation upon the subcortical temperatures is very marked throughout the entire season. In general, the stronger the sunlight the higher the subcortical temperature, altho this is somewhat modified by other factors.

*TABLE II**

Solar Altitudes for 48 Degrees North Latitude

	Sun's hour angle from meridian															
	0		1		2		3		4		5		6		7	
	°	′	°	′	°	′	°	′	°	′	°	′	°	′	°	′
Dec. 21	18	33	17	17	13	39	7	58	0	38						
Jan. 21	22	06	20	47	16	59	11	05	3	32						
Feb. 21	31	29	30	00	25	45	19	34	11	10	2	00				
Mar. 21	42	16	40	31	35	40	28	29	19	47	10	10	0	12		
Apr. 21	53	53	51	46	46	04	38	02	28	43	18	49	8	48		
May 21	62	12	59	40	53	10	44	29	34	47	24	47	14	53	5	25
June 21	65	26	62	44	55	53	46	56	37	10	27	06	17	16	7	53
July 21	62	29	59	57	53	25	44	42	35	00	24	59	15	05	5	37
Aug. 21	54	07	51	59	46	16	38	12	28	53	18	59	8	58		
Sept. 21	42	42	40	56	36	04	28	52	20	09	10	31	0	32		
Oct. 21	31	17	29	48	25	34	19	23	10	59	1	49				
Nov. 21	22	04	20	45	16	57	11	03	3	30						

*From Kimball, Herbert H., Monthly Weather Review, Vol. 47, No. 11, p. 771.

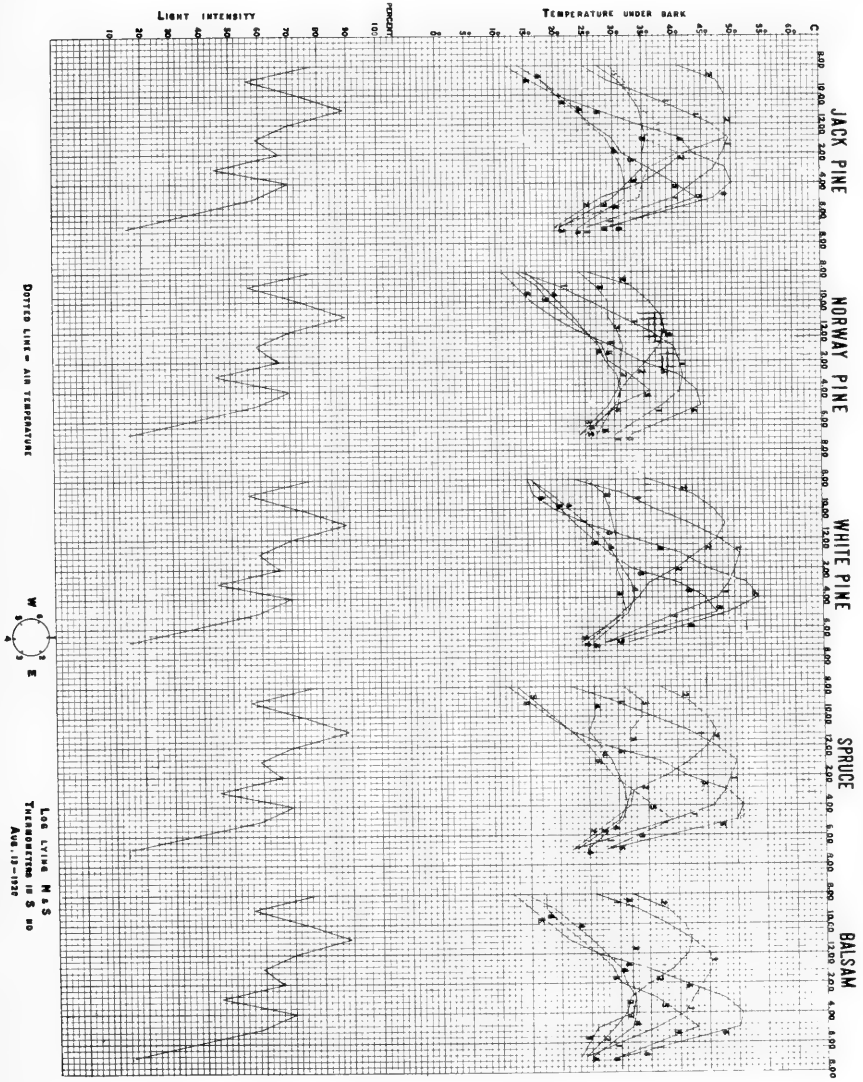
JACK PINE
NORWAY PINE
WHITE PINE
SPRUCE
BALSAM
TEMPERATURE UNDER BARK
LIGHT INTENSITY
PERCENT
DOTTED LINE = AIR TEMPERATURE
LOG LYING N & S
THERMOMETER 18 S DO
AUG. 11-1922

Plate III.

The difference in temperature due to change in solar altitude is not very noticeable during June and July, as the total noon variation during this period is only about 3 degrees. During August, however, the difference becomes much more marked, with a reduction of noon altitude of nearly 12 degrees. This change in solar altitudes affects the subcortical temperature in two ways: (1) By an actual reduction of the possible amount of radiation due to the greater absorption of heat by the atmosphere as the altitude of the sun is lowered; and (2) by changing the angle of incidence of the sun's rays upon the log. Thus on a warm sunny day in September we can not expect as high a subcortical temperature as would obtain on a similar day in June or July.

The amount of heat absorbed by the surface of the bark depends considerably upon the angle of incidence of the sun's rays. The more vertical the rays the greater the absorption. When the angle of incidence is very great, a large proportion of the rays will be reflected from the surface of the bark and very little heat will be absorbed. This is shown very clearly by a comparison of the late afternoon or early morning temperatures of logs standing on end with those of logs lying east and west.

EFFECT OF CHARACTER OF BARK

The color of the bark is one of the most important factors determining the height of subcortical temperatures. The lighter colored the bark the cooler the log. This effect is evident when white pine is compared with thin-barked norway or jack pine. The white pine was the darkest colored log of the series of species used and its temperature was higher in every case than any of the others. With a white bark, such as that of the paper birch, the opposite extreme is illustrated. While no birch logs were included in this series of experiments, it has been noticed incidentally that there is a very marked difference in temperature between the normal white bark and the black areas resulting from peeling the bark. This difference is often so great in the bright sunlight that it can easily be observed without the aid of a thermometer by touching a dark area and a white area with the hand.

The importance of color was well shown by an experiment in which normal temperatures for a set of logs were compared with temperatures in the same logs when painted first white and then black. In this way only one factor was changed appreciably, and its effect could

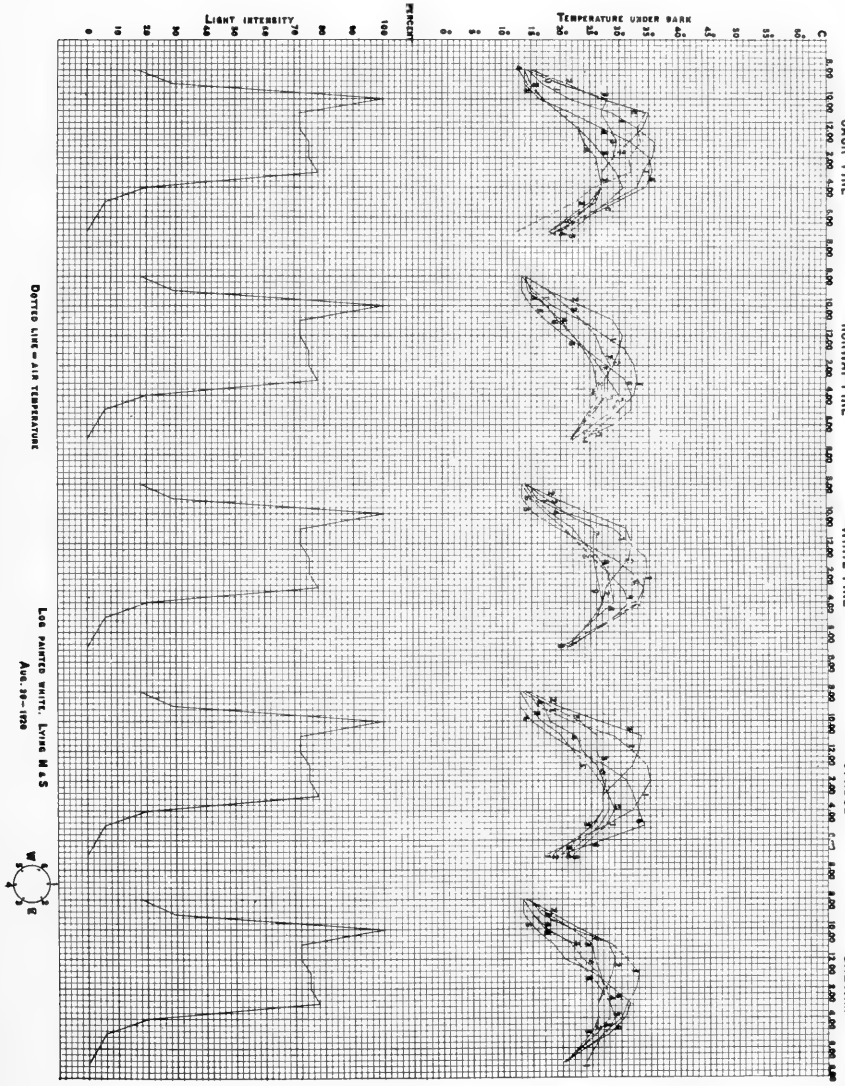
JACK PINE
NORWAY PINE
WHITE PINE
SPRUCE
BALSAM
TEMPERATURE UNDER BARK
LIGHT INTENSITY
PERCENT
DOTTED LINE = AIR TEMPERATURE
LOG PAINTED WHITE. LYING N & S
AUG. 29 - 1920
W
E

Plate IV.

be directly observed. The results were exceedingly striking and are illustrated graphically in Plates III, IV, and V. In the white log the temperature scarcely exceeded air temperature while in the black painted log the temperature became extremely high.

The surface of the bark also has a decided influence upon subcortical temperatures. Assuming that the sun's rays strike the log nearly vertically, rough bark will absorb more heat than smooth bark, owing to its greater absorbing surface. If the sun's rays strike the log at an angle, each surface roughness will cast a shadow, thus reducing the absorbing surface. The area in shadow increases with an increase of the angle of incidence until a point is reached at which the smooth bark absorbs more heat than the rough bark and therefore shows a higher temperature. This change, of course, would vary with different logs even of the same species and is dependent upon the degree of surface roughness. In a set of white pine logs lying in full sun, the smooth bark reached higher temperatures during the early and latter parts of the season while in midsummer the rough bark was the warmer. These logs were not moved during the course of the experiment and this change seems to be explainable only on the basis of the variation in solar altitude with the resulting change in the angle of incidence and the amount of shading on the rough bark.

Some barks are better insulators than others. This is due primarily to differences in structure. Of the five species used in the work, the norway pine bark was by far the most effective as an insulator. This was due in part to the color, as has already been mentioned, but its effectiveness was also due to its structure. On the basis of structure we may divide barks into at least three groups: (1) Dense, solid bark, containing few air spaces such as the white pine and balsam; (2) thin bark covered with one or two layers of loose scales as spruce or jack pine, and (3) bark composed of layer upon layer of scales, as that of norway pine. The first type is the poorest insulator, owing largely to the lack of air spaces. The second is usually poor or medium as an insulator, owing to its thinness and to the fact that the part of the scale closely appressed to the inner bark serves as almost as good a conductor as the dense thin bark. The third type, however, is a very effective insulator. In this type the bark is made up of many loosely appressed layers of thin scales with small air spaces between. Thus it is that very thin norway pine bark does not reach as high temperatures as white pine bark two or three times as thick.

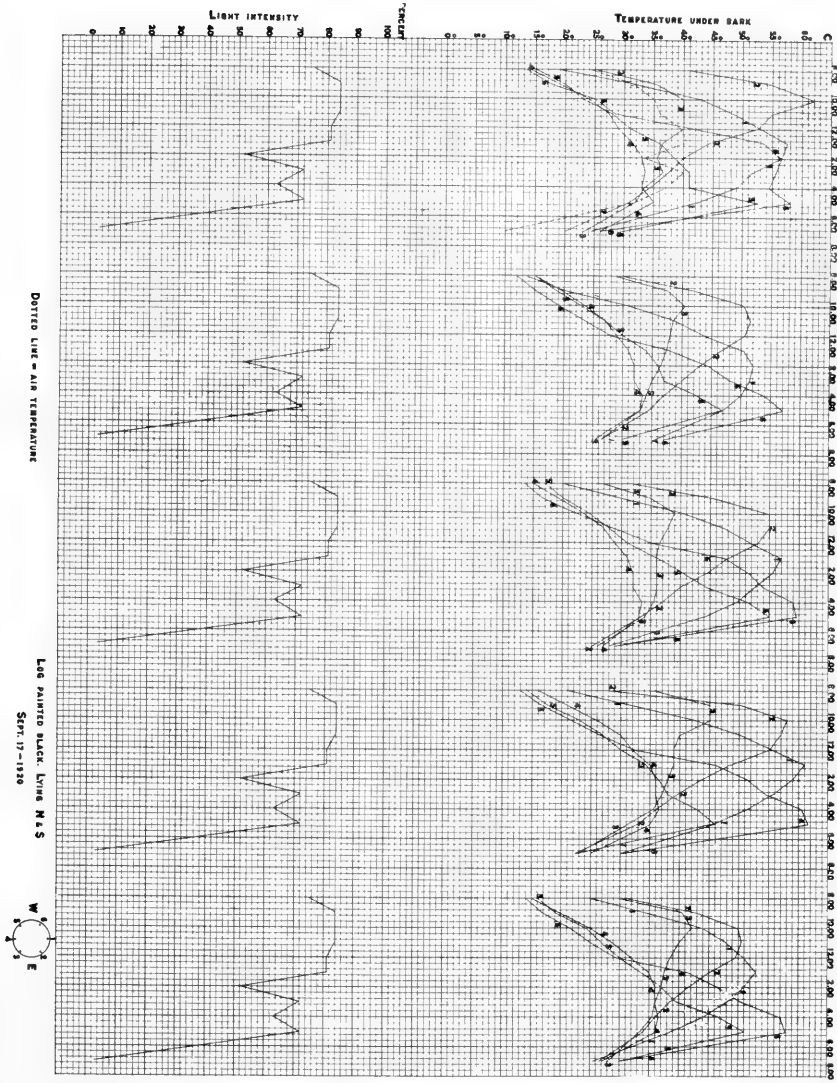
JACK PINE
NORWAY PINE
WHITE PINE
SPRUCE
BALSAM
TEMPERATURE UNDER BARK
LIGHT INTENSITY
PERCENT
DOTTED LINE = AIR TEMPERATURE
LOG PAINTED BLACK. LYTHE M & S
SEPT. 17—1920
W
E

Plate V.

Effect of Air Temperature and Air Movement

As previously stated, the term air temperature as used in this article refers to the temperature in the open, as recorded by a white bulb thermometer. The influence of air temperature is almost entirely over-shadowed and obscured by the influence of light. At the same time it is important and can not be disregarded. On cloudy days and at night the subcortical temperatures followed very closely the temperature of the air, so it is not unjustifiable to assume that in practically all cases in the absence of sunlight the temperature within the log would follow air temperature in a general way. There would always, of course, be a lag on the part of log temperature depending upon the insulating properties of the bark.

The amount of this lag would also be influenced by the effect of air movement upon the rate of radiation. The graph illustrating the daily course of temperature in a standing log (Plate I) shows how air currents increase radiation and cause rapid fluctuation in the subcortical temperature.

This fluctuation is also influenced to a considerable extent by the fact that the surface of the standing log is removed from close proximity to other absorbing and radiating surfaces which tend to stabilize the temperatures in the log near the ground.

Effect of Evaporation From the Surface Layer of the Bark

Frequently on clear mornings following a night when there was a heavy dew the temperature of logs under the lath shades where there was no dew was nearly equal to or occasionally slightly higher than that of logs lying in the open with the sun striking directly upon them. This condition lasted but a short time and as soon as the moisture had evaporated from the surface of the bark the logs in the sun rapidly increased in temperature. The most logical explanation of this phenomenon appears to be based upon the cooling effect of evaporation.

The cooling effect of evaporation was also apparent after rains. If two similar days are selected, one following a rain and the other following a period of dry weather, the temperature of the log is usually lower on the day following the rain than on the day following dry weather. This condition is illustrated by Table III.

TABLE III

Preceding weather	Date	Species	Light	Air temp.	Actual log temp.	°C. above air temp.
			Pct.	Deg. C.	Deg. C.	
2 inches rain	July 24	White pine	93	35	55	20
Clear	Aug. 2	White pine	85	35	57	22
2 inches rain	July 24	Norway pine	93	35	45	10
Clear	Aug. 2	Norway pine	85	35	47	12
1.75 inches rain	July 14	White pine	52	29	45	16
Clear	July 29	White pine	45	29	47	18
1.75 inches rain	July 14	Norway pine	52	29	36	7
Clear	July 29	Norway pine	45	29	40	11
Mist	July 8	White pine	90	38	55	17
Clear	July 10	White pine	88	34	54	20
Mist	July 8	Norway pine	90	38	52	14
Clear	July 10	Norway pine	88	34	50	16

From Table III it would appear that moisture evaporating from the surface layers of the bark may hold down the temperature within the log to an appreciable degree.

CONCLUSION

As a result of this work it appears that in many instances the weekly turning of logs, as recommended by Craighead, would be effective in destroying many wood-boring insects. This is particularly true of logs with moderately thin dark colored bark. It is equally evident from the discussion that the method does not apply in all cases, as some logs will remain below the temperature fatal to insects even on very bright warm days.

In using this method it must be remembered that it is not only necessary to put the logs in the sun, but it is also important to consider the position of the log with reference to the sun. The question of how far the log should be turned each time depends largely upon the position of the log. Logs lying east and west will often reach a higher temperature in a small area than logs lying north and south, but the latter will be heated over a much greater surface.

SUMMARY

1. In bright sunlight, subcortical temperature on the upper side of moderately thin barked logs often passes above a point fatal to the insect inhabitants of the log.

2. That this is not necessarily true of all logs is illustrated by certain norway pine logs which did not exceed 46 degrees C. during the entire summer of 1920.

3. The position of the log with reference to the sun's rays determines the portion which will attain a high temperature. Logs lying east and west will have only a comparatively narrow strip heated, while almost half of a log lying north and south may exceed the temperature fatal for insects.

4. Conduction of heat around the log is slow but varies somewhat in rate with different species.

5. One of the primary factors bringing about high temperatures in logs is solar radiation. The effect depends upon light intensity, solar altitude, and the angle of incidence of the sun's rays.

6. The bark characteristics which affect log temperatures are (a) Color. Dark bark absorbs heat much more rapidly than light colored bark. (b) Surface. Rough bark provides a larger absorbing and radiating surface than smooth bark and gives higher temperatures provided the angle of incidence is not great. (c) Structure. Scaly bark is a better non conductor than bark of a uniform texture and therefore tends to hold down the temperature. (d) Thickness, which tends to increase insulation.

7. In the absence of solar radiation the subcortical temperature follows rather closely the temperature of the surrounding air.

8. Air movement tends to increase radiation and therefore tends to reduce the subcortical temperature.

9. Close proximity to other radiating or absorbing surfaces tends to stabilize the subcortical temperature.

10. Evaporation of water from the surface layers of the bark, which often occurs in the early morning or following a rain, tends to reduce the temperature beneath the bark.

STUDIES ON THE FLIGHT OF NOCTURNAL LEPIDOPTERA[1]

By William C. Cook

The data here presented were accumulated during the summer of 1920 at University Farm, in connection with general ecological studies of the Noctuidae of the cutworm and army worm groups, including the genera Agrotis, Septis, Sidemia, Euxoa, Feltia, Cirphis, Polia, and their near relatives. Many of these species are of considerable economic importance in the state because of their attacks on farm crops. The discussion will be limited in this paper to two questions, seasonal and meteorological relations of the adult moths.

The only previous work on the flight of Minnesota Noctuidae is that of Lugger (1)[2] which gives a list of species captured, the duration of their flight, and their abundance as "rare," "common," or "very common." In 1919, collections were made by sugaring about twice a week at University Farm, but the numbers so obtained were not sufficiently large to give data of any accuracy, so in 1920 it was decided to use more systematic methods of collection. As the moths are very strongly attracted to sugar, the writer determined to try a form of bait trap similar to that used in Europe against the vine moths (Dewitz, 2). In this instance six-inch flower pots were used. They were varnished on the inside and the hole in the bottom was plugged with a cork. The pots were then suspended by strings from the apple trees of the station orchard, at a height of from three to three and a half feet, and filled with a ten per cent solution of molasses in water. This fermented within a few hours and remained attractive for three or four days, when it was renewed by the addition of about half the volume of fresh solution. The moths were attracted in large numbers and drowned in the solution, no provision for retaining them being necessary. Even the larger species of Catocala were thus caught. The moths were collected each morning, with the exception of about ten days noted below, and the various species separated and counted.

The use of bait traps for the control of Noctuidae is by no means new, having been practised in Russia for controlling *Euxoa segetum*

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1 Published with the approval of the Director as Paper No. 258, of the Journal Series of the Minnesota Agricultural Experiment Station.

2 Numbers in parentheses refer to literature cited. See end of paper.

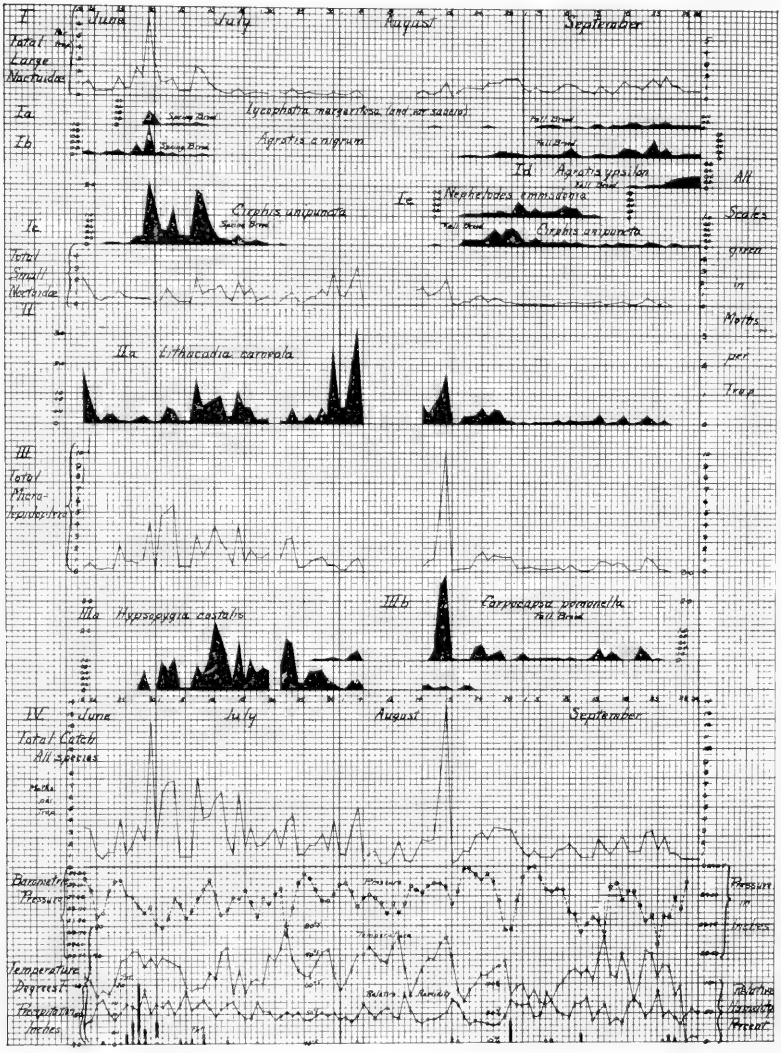

Plate VI. Seasonal Abundance of Nocturnal Moths at St. Anthony Park, Minnesota, 1920. (Original)

and *Feltia exclamationis* (Dobrovljansky, 3), where long troughs filled with fermenting molasses were exposed in the fields; and also in India, where large "Andres-Maire" traps proved very successful in controlling *Agrotis ypsilon* on limited areas. (Woodhouse and Dutt, 4).

I. Seasonal Relations of Minnesota Moths

During the time from June 18 to September 30, 1920, about sixty-five of the traps described above were in operation, and some of the results are shown graphically on Plate VI. The moths captured were grouped in three classes: large Noctuidae, including all species of such subfamilies as the Acronyctinae, Agrotinae, Cuculiinae, Hadeninae, Poliinae and larger Catocalinae; small Noctuidae, including the smaller species and the Deltoids; and Microlepidoptera, including all micros caught, chiefly Tortricidae. Curve IV gives the total catch of all species, rated in moths per trap. Curves I to III show the catches of the three groups listed above; and the small curves, which are on a scale two and a half times that of the principal curves, give the numbers of some of the more abundant species of each group. Table I gives the data for these species and all others which were identified, showing the total catch and seasonal range of each species. Several of the species are recorded as being captured previous to June 18, as about fifteen traps were in continuous operation from the first of April. The meteorological data represented on Plate VI will be discussed in the second part of the paper.

TABLE I. SEASONAL ABUNDANCE OF NOCTURNAL MOTHS DURING 1920

Species	First moths	Last moths	Maximum emergence	Total catch	
Agrotis bicarnea	Aug. 24	Aug. 29	.....	11	
A. c-nigrum					
First brood	June 17	July 8	June 26-29	100	
Second brood	Aug. 21	Sept. 30	Sept. 17-24	289	
A. ypsilon					
First brood	July 15	July 16	.....	2	
Second brood	Sept. 18	Sept. 30	Sept. 25-30	75	
Lycophotia margaritosa and var. *saucia*					
Earliest	May 5	.....	.....	1	
First brood	June 27	July 13	June 29-30	56	
Second brood	Aug. 16	Sept. 26	Sept. 15-20	90	
Feltia ducens	July 14	Sept. 22	September	125	
F. gladaria	July 29	Sept. 17	.....	13	
Sidemia devastator	Aug. 13	Aug. 25	.....	45	
Agroperina dubitans	Aug. 21	Aug. 23	.....	17	
Septis lignicolora	July 8	July 16	.....	7	
Polia lorea	June 10	July 8	June 28-30	72	
Cirphis unipuncta					
First brood	June 23	July 21	June 28-July10	669	
Second brood	Aug. 16	Sept. 26	Aug.20-30	395	
Nephelodes emmedonia	Aug. 20	Sept. 12	Sept. 1-7	236	
Unidentified species	.....	.....	.....	1,581	
		Total large Noctuidae			3,784
Lithacodia carneola	Broods not well marked			1,996	
Balsa malana					
First brood	May 21	July 9	June 9-13	226	
Second brood	July 19	Sept. 2	July 20-30	337	
Epizeuxis (3 species)	June 24	Sept. 24	July 15-17	299	
Euclidea cuspidea	May 28	July 17	June 10-20	261	
Drasteria sp.	July 16	Aug. 24	July 25-Aug. 5	139	
Unidentified species	.....	.....	.....	319	
		Total small Noctuidae			3,577
Hysopygia costalis	June 28	Aug. 18	July 10-15	1,446	
Carpocapsa pomonella					
Second brood	July 22	Sept. 24	Aug. 15-20	919	
Unidentified species (chiefly Tortricidae)				4,052	
		Total Microlepidoptera			6,417
		Grand total, all species			13,778

In general, the season was marked by the scarcity of cutworm moths. No specimens of *Septis arctica*, normally an abundant species, or of any species of *Euxoa* were captured. The hot, dry weather of late July and early August materially reduced the numbers of the second broods of the various species, especially *Cirphis unipuncta*, of which the number caught was less than that of the overwintering brood. It is evident that *Agrotis c-nigrum* and *A. ypsilon* are double-brooded in this region. *A. c-nigrum* was reared during the summer from eggs obtained from a moth caught alive in the traps in June, and the second brood emerged at about the time of the peak of the second brood in the field. The first brood of *Carpocapsa pomonella* was not recorded, and must have been present in very small numbers. The abundance of *Balsa malana* is quite unusual. Lugger (1) records the species as "rare." The larva lives on apple, but so far as is known, it is not of economic importance here. The bulk of the unidentified Microlepidoptera belonged to two or three species of leaf-rollers, but were not separated, as not being of importance in this study.

II. Meteorological Relations of Minnesota Noctuidae

In this section it is proposed to treat briefly the influences of the various weather factors on the flight of the larger Noctuids (Group I, Table I). It would undoubtedly be better to deal with a single species, but it is quite evident from Plate VI that all of these species react in a similar manner, and the figures are more reliable, being based on a much larger number of individuals.

The data on which this treatment is based are given in full in Table II. Many of the traps were used at various times in experiments with different baits, so it was thought best to exclude their catches during such periods from this consideration, and treat only those caught on the single bait. During the period from August 4 to August 13, the writer was unable to attend personally to the traps, and the catches were preserved in alcohol. The species could not be determined with any accuracy, so only the total catch is given on Plate VI, and those dates are omitted from this discussion. The catch for July 20 was lost, and is also omitted.

In order to obtain data which would eliminate as far as possible the variations in catch due to the emergence of species, the following treatment was resorted to. A "sliding average" or "normal" catch was computed by taking the average of the catches for the first five days, placing this opposite the middle day of the period; dropping the

first day, adding the sixth, placing the average for these days after the fourth day, and so on. This is given in column 5, Table II. The daily catch was then computed as a percentage of the normal catch, a catch of 100 being normal. This method practically eliminates the emergence curves, replacing them by a smoothed normal curve, from which variations are taken. The remaining columns are self-explanatory. The weather data were obtained as follows: The temperature represents the mean between 9 p. m. and 5 a. m., obtained by integrating the curve of a thermograph exposed in the field. By this method a better measure of the temperature is obtained than by averaging maximum and minimum (Hartzell, 5). The relative humidity represents the 7 p.m. observation taken at the Minneapolis United States Weather Bureau station, and is used in default of any observations taken in the field. This does not represent the actual night conditions in the field, the humidity on any night actually becoming much higher before morning; but it is a good index of conditions on successive nights, when considered in connection with the temperature. A 7 p.m. humidity of 54 per cent at a temperature of 70 degrees F. indicates a dew point of about 51 degrees F., which would probably not be reached during the night. Normally the temperature falls constantly during the night, reaching its lowest value about 6 a. m. in the summer. The records of pressure and precipitation are also from the records of the Minneapolis station, the precipitation being correlated with field notes taken by the writer, and the pressure being integrated from the station record from 9 p. m. to 5 a. m.

TABLE II. MOTH FLIGHT AND METEOROLOGICAL DATA

Date	No. traps	Total moths	Moths per trap	Normal	Per cent of normal	Temp. °F.	Rel.hum. per cent	Bar.press., inches	Ppt., inches
June									
18	24	21	0.87	....	....	63	35	29.15	
19	29	34	1.17	....	....	61	40	29.05	
20	29	11	0.38	0.65	58.5	57	69	28.83	
21	29	11	0.38	0.57	49.5	58	76	28.86	
22	29	13	0.45	0.63	71.2	57	52	29.05	
23	29	13	0.45	0.59	76.0	61	41	29.13	
24	22	33	1.50	0.72	207.8	68	52	29.14	
25	34	19	0.56	1.12	50 3	69	68	29.01	0.60*
26	34	22	0.65	1.33	48.8	71	63	29.00	0.78*
27	44	102	2.42	2.39	101.0	71	67	28.93	0 05*
28	44	67	1.53	2.83	54 0	66	91	28.86	2.38*
29	44	299	6.80	2.94	231.0	69	51	28.92	
30	44	122	2.77	2.67	103.7	66	67	28.78	0.75
July									
1	42	50	1.19	2.66	44.8	69	63	28.73	
2	42	45	1.07	1.36	85.0	68	72	28.83	
3	42	61	1.45	0.90	160.8	67	53	28 98	
4	43	17	0.40	0.74	54.0	66	69	28 93	0.25*
5	43	17	0.40	1.02	39 0	59	90	28.82	0.12*
6	43	18	0.40	1.17	34 0	58	57	28.88	0.10*
7	43	106	2.46	1.33	185.0	59	65	28.98	
8	44	96	2.18	1.38	157.0	59	72	29.06	0.04
9	44	53	1.21	1.39	87.0	64	60	29.14	
10	44	29	0.66	0.94	69.9	62	47	29.02	
11	39	17	0.44	0.57	77.2	71	57	28.84	
12	39	9	0.23	0.45	51.6	73	68	28.88	0.11
13	39	12	0.31	0.35	87.6	57	72	28 99	
14	39	23	0.59	0.32	185.6	65	51	28.97	
15	39	8	0.20	0.34	59.1	57	41	29.05	
16	39	10	0.26	0.34	76.1	61	43	28.95	
17	39	13	0.33	0.28	119.6	62	70	28.82	Trace
18	39	13	0.33	0.32	101.9	60	53	28 98	
19	39	10	0.26	0.35	74.7	70	54	28.94	
20	..	..	....	....	....	68	40	29.02	
21	64	28	0.44	0.40	110.0	72	47	29.07	
22	64	24	0.38	0.41	93.6	81	53	28.68	
23	64	38	0.59	0.43	138 5	69	49	28 90	
24	64	23	0.36	0.43	84.5	65	51	29.12	
25	64	23	0.36	0 40	90.0	63	40	29.19	
26	64	28	0.44	0.33	134 2	63	40	29.15	
27	64	16	0.25	0.29	86.2	67	47	29.05	
28	64	15	0.23	0.31	73.2	71	53	28.97	
29	64	11	0 17	0.27	63.0	72	49	28 96	
30	64	31	0.48	0.26	181.9	63	51	29 02	
31	64	14	0.22	0.28	77.5	58	40	29.10	
August									
1	64	14	0.22	0.36	60.7	61	44	29.12	
2	64	21	0.33	0.28	116.2	65	37	29.04	
3	64	36	0.56	....	....	70	47	28.92	0.04
4	64	6	0.09	....	....	70	69	28.99	
..	..	..	....	....	....	..	..	.....	
13	64	18	0.28	....	....	61	39	29.05	
14	64	33	0.51	....	....	65	34	29.03	

Date	No. traps	Total moths	Moths per trap	Normal	Per cent of normal	Temp. °F.	Rel.hum. per cent	Bar.press., inches	Ppt., inches
August									
15	64	23	0.36	0.39	90.9	69	40	29.09	
16	64	19	0.30	0.61	49.0	68	40	29.11	
17	64	34	0.53	0.53	100.0	74	46	29.10	
18	64	87	1.36	0.55	245.8	76	51	29.07	
19	64	5	0.08	0.67	12.9	69	77	28 93	0.16
20	64	32	0.50	0.74	67.9	58	65	29.04	0.07
21	64	56	0.88	0.63	140.6	54	43	29.23	
22	64	55	0.86	0.59	145.8	58	32	29.24	
23	64	52	0.81	0.88	91.6	60	39	29.18	
24	59	41	0.70	0.96	73.0	63	35	29.14	
25	59	69	1.17	1.04	112 9	63	32	29 18	
26	59	74	1.25	1.19	104 9	65	30	29.12	
27	59	74	1.25	1.37	91.4	66	34	28 96	
28	59	94	1.59	1.45	109.7	68	48	28.71	
29	59	94	1 59	1.36	117.3	56	73	28 72	0.75
30	59	93	1.57	1.21	130 2	59	66	28.96	
31	59	46	0.78	1.08	72.5	60	65	29.16	
September									
1	64	32	0.50	0.87	57.8	55	68	29.24	
2	63	59	0.94	0.66	143.3	58	44	29 25	
3	63	34	0.54	0.60	89.7	54	48	29.16	
4	63	33	0.52	0.66	78.3	53	87	29.05	0.04
5	63	32	0.51	0.71	71.8	54	73	29.04	0.07
6	63	51	0.81	0.68	118.4	59	54	29.06	
7	63	74	1.17	0.94	125.0	61	49	29.05	
8	63	76	1.21	0.94	127.5	64	47	28.86	
9	63	62	0.98	0.89	110 6	65	67	28.84	
10	61	33	0.54	0.74	73.0	63	68	28.69	0.36
11	61	32	0.53	0.70	75.5	65	76	28.76	
12	61	27	0.44	0.63	70.1	61	39	28 82	
13	61	62	1.02	0.60	170 0	68	52	28 74	
14	61	37	0.61	0.65	93.6	76	66	28.68	
15	60	24	0 40	0.86	46.5	63	31	29.07	
16	61	43	0.79	0.87	91.2	62	40	29 10	
17	61	90	1 48	0.95	155 2	70	35	28.96	
18	59	62	1.05	1.02	102.5	63	61	29.04	
19	59	62	1.05	1.12	94.1	54	77	29 03	
20	59	44	0.75	1.15	65.5	61	66	28.91	
21	41	51	1.25	1.15	109.1	71	45	28 79	
22	41	67	1.63	1.32	124.0	70	54	28 83	
23	41	43	1.05	1.39	75.8	62	88	28 58	
24	41	78	1.90	1.35	141.0	66	46	28 82	0 02
25	32	35	1.10	1.16	94.8	66	51	28 82	0.31
26	32	34	1.06	1.09	97.3	56	41	28.98	
27	29	20	0.69	0 85	81.6	60	31	28 86	
28	29	20	0.69	....	....	40	48	29.12	
29	29	20	0.69	....	....	..	..	.....	

In working with the figures presented in Table II, the data for the seven nights marked with an asterisk (*) were omitted, as showing the effects of precipitation, leaving a total of eighty observations, on which all computations are based.

A comparison of Curve I, Plate VI, with the weather curves of the same plate makes it quite evident that weather factors have a considerable influence on the size of the catch, but the effects are somewhat obscured by the variations in the curve caused by the irregular emergence of the various species. In order to show the fluctuations due to weather alone, Plate VII was drawn, on which the first curve represents the per cent of "normal" catch (Column 6, Table II). The remaining weather curves are from the same data given in Table II. A study of this graph brings out the following tendencies.

1. The fluctuations in catches can not be closely correlated with any one of the weather curves, but the catch apparently tends to increase with a rise in temperature, and decreases as either humidity or pressure deviates very far in either direction from the optimum indicated by parallel lines.

2. The relative effects of the various factors are greater, the farther the condition departs from the optimum.

3. The largest catches were made when all factors were at or near their respective optima.

In order to show these effects more clearly, charts were made by plotting the percentage of normal catch against temperature, humidity, and pressure in turn. These charts are shown on Plate VII, numbered V, VI, and VII. The tendencies mentioned show up quite clearly, especially the effect of the optimum humidity condition.

To bring out the relative values of the various factors, recourse was had to statistical methods, and the method of partial correlation, as developed by Yule (6) and as applied to crop yields and weather factors by Blair (7, 8) was adopted. Without attempting to deal with the mathematics of the method, it may be said that the correlation coefficient is a pure number, mathematically obtained, which indicates the tendency of one factor to vary with or in opposite direction to another. If the factors are closely related, a value approaching unity is obtained, and if totally unrelated, a value near to zero. The sign of the coefficient indicates the character of the correlation, a plus (+) sign meaning that an increase in one factor is related to an increase in the other, and a minus (—) sign that an increase in one factor is related to a decrease in the other. The notation employed is to designate the coefficient as "r," with subletters or numbers indicating the factors

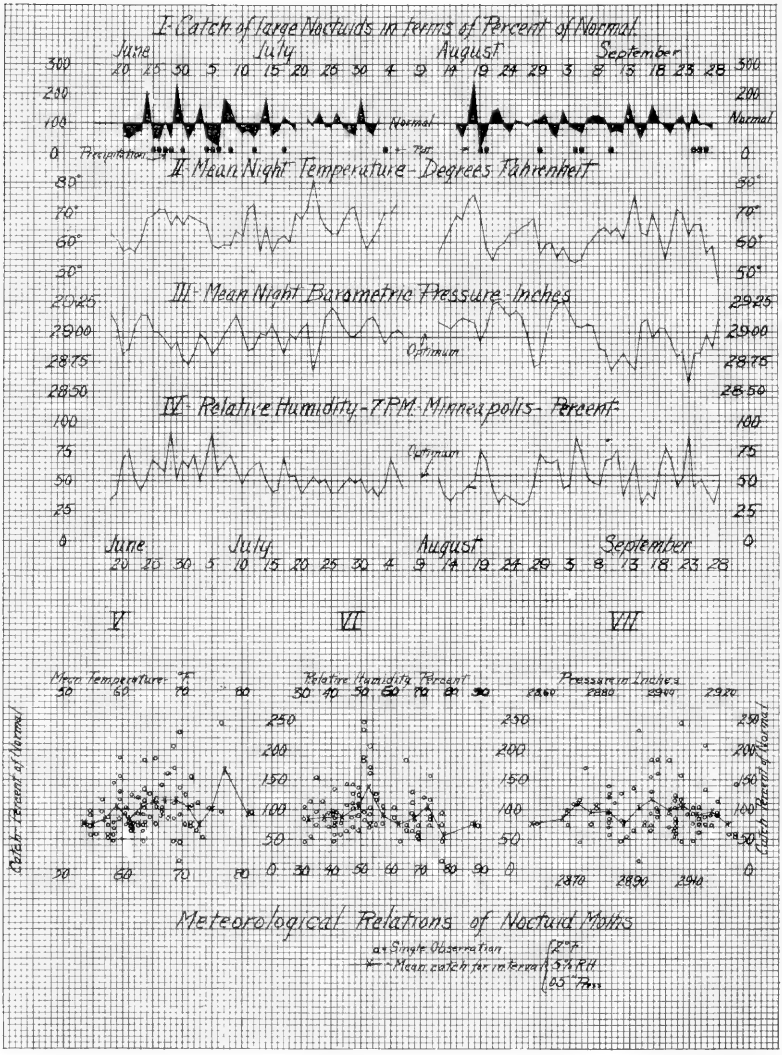

Plate VII. Meteorological Relations of Minnesota *Noctuidae*. (Original)

correlated. Thus "r_{ct}" is the correlation of catch with temperature, etc. The "total" coefficients show the relationships between two factors, in the presence of all others, and it is necessary to treat this mathematically in order to eliminate the effects of the other factors leaving a "partial" correlation coefficient which gives the correlation between the first and second factors, the others being eliminated. The notation for the partial coefficients is similar to that for the total coefficients, except that the two factors correlated are given first in the subscript, followed by a period, then by the factors eliminated. Thus "$r_{ct.\,p}$" is the correlation beteen catch and temperature, pressure being eliminated, and "$r_{ct.ph}$" the correlation between catch and temperature, both other factors being eliminated.

Coefficients such as the last are obtained in two steps, one factor being eliminated at a time by the application of a formula of the following form:

$$r_{ct.\,h} = \frac{r_{ct} - (r_{ch} \times r_{th})}{(1 - r_{ch}^2)^{1/2} \quad (1 - r_{th}^2)^{1/2}}$$

which gives the coefficients of the "first order." The remaining factor is then eliminated from each coefficient by the similar formula:

$$r_{ct.\,hp} = \frac{r_{ct.\,h} \quad (r_{cp.\,h} \times r_{tp.\,h})}{(1 - r_{cp.\,h}^2)^{1/2} \quad (1 \quad r_{tp.\,h}^2)^{1/2}} \quad \text{(Yule, 6, p. 238)}$$

As correlation makes the assumption that the relation between the variables correlated is a straight line, it becomes necessary to divide the data on the basis of humidity in such a way that the humidity curve becomes two approximately straight lines. This is done by dividing the data at the optimum, making one set of correlations with the data below 54 per cent relative humidity, and another set with those above 50 per cent, including the optimum in both sets.

TABLE III. CONSTANTS OF THE FREQUENCY CURVES

Factor	Entire Curve	Below 54 Pct. Rel. Hum.	Above 54 Pct. Rel. Hum.
No. of observations	80	49	44
Catch, per cent of normal			
Mean	100.13 ±3.30	107.9 ±42.0	105.1 ±52.5
St. Dev. ...	43.88 ±2.36	47.0 ±32.1	51.7 ±35.3
Temperature, (°F.)			
Mean	63.55 ± .441	64.95 ± .541	64.32 ± .659
St. Dev. ...	5.85 ± .314	5.62 ± .383	6.43 ± .438
Relative humidity (%)			
Mean	54.45 ±1.11	44.35 ± .654	63.64 ± .976
St. Dev. ...	14 72 ± .791	6.79 ± .464	10.15 ± .731
Barometric pressure (Inches)			
Mean	28.97 ± .013	29.00 ± .013	28.92 ± .015
St. Dev. ...	.174± .009	.139± .009	150± .010

Below, in Table IV, are given the total correlation coefficients for all the combinations of factors, and the partial (second order) coefficients for catch with the other variables. Space does not permit the publication of the original correlation tables.

TABLE IV. CORRELATION OF MOTH FLIGHT WITH METEOROLOGICAL FACTORS

Factors Correlated	7 P.M. Relative Humidity Below 54%		7 P.M. Relative Humidity Above 54%	
	r—Total	r—Partial	r—Total	r—Partial
Catch—Temp.	r_{ct} +.34±.085	$r_{ct.\,hp}$ +.28±.089	r_{ct} +.19±.098	$r_{ct.\,hp}$ +.02± 102
Catch—Humidity	r_{ch} +.37±.083	$r_{ch.\,tp}$ +.31±.087	r_{ch} —.46±.080	$r_{ch.\,tp}$ —.35±.089
Catch—Pressure	r_{cp} —.17±.094	$r_{cp.\,th}$ +.06±.095	r_{cp} +.18±.098	$r_{cp.\,th}$ +.09±.101
Temp.—Humidity	r_{th} +.25±.090		r_{th} —.47±.079	
Temp.—Pressure	r_{tp} —.45±.077		r_{tp} —.40±.085	
Humidity—Pressure	r —.32±.085		r —.20±.098	
Multiple Correlation	$R_{c.\,thp}$ +.45± 07		$R_{c.\,thp}$ +.47±.08	

In every case the partial coefficients are smaller than the corresponding total coefficients, owing to the fairly high correlation between the weather factors themselves. The following conclusions may be drawn from a study of the partial coefficients.

1. Temperature and humidity are much more closely correlated with size of catch than pressure, the two partial coefficients for the latter being smaller than their probable error.

2. Temperature has a positive influence on the catch at all times, but the influence is much larger below than above optimum humidity.

3. Humidity is by far the most important factor studied. Any increase in the 7 p.m. humidity up to about 54 per cent tends to increase the catch, while beyond this value it decreases the catch in almost the same proportion.

4. The coefficients of multiple correlation (designated by large R) for the two sets of data have been computed, which give the total amount of correlation between any factor and all others at once. Their derivation and use will be found in Yule (6) and will not be discussed here. These coefficients are included in Table IV. They are of approximately equal value, both less than 0.50, indicating that about half of the factors influencing the catches have been neglected in this study. Among these might be mentioned wind velocity, moonlight, and precipitation during the daylight hours, which undoubtedly have considerable influence, considered collectively.

The writer is not at all satisfied that the method of partial correlation is the best possible method of determining the relative values of the factors involved, owing primarily to the assumption of linearity of relationship between the factors, but it at least represents a considerable advance over the method of estimating these relationships by inspection of a graph. The correlation coefficients are not in any sense an accurate measure of this relation, but they are at least a relative or qualitative measure, and must be so interpreted.

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THE PRINCIPLES OF FILM-FORMING SPRAYS[1]

By William Moore

When a spray is applied to plants having leaves with a waxy surface or heavy cuticle, it usually collects in drops and rolls off the foliage instead of forming a film over the surface of the leaf. In this paper an attempt is made to explain the forces which cause the spray to collect into drops or to spread out into a thin film, and to point out how the more desirable film-forming sprays may be made. No definite recommendation of any particular substance will be made, further work is necessary before a decision can be reached as to which material will give the best results when cost and other factors are considered.

When a drop of liquid falls through the air it assumes a spherical shape, as this form gives the smallest surface for a given volume. The reduction of the surface to a minimum is explained by the unequal forces of attraction exerted on the molecules at the surface of the liquid. In the interior of the drop any particular molecule is surrounded on all sides by similar molecules and the force of attraction acting on the molecule is the same on all sides. If, however, a molecule at the surface of the drop is considered, it will be seen that on all sides but one it is surrounded by the molecules of the liquid, while on the external side it is in contact with the dissimilar molecules of the air. Since the attraction between the molecules of the liquid and those of the air is less than the attraction between the similar molecules of the liquid, there is a definite force tending to pull the molecule at the surface into the interior of the liquid. This force will reduce the number of molecules in the surface to the smallest possible number, thus producing a minimum surface. The liquid will exhibit at its surface a certain tension which is known as surface tension.

If the surface of the liquid is to be increased, more molecules must be brought into the surface layer, and since the strongest pull on the molecule is toward the interior, sufficient force must be applied to overcome this attraction of the like molecules. The force necessary to bring sufficient molecules from the interior of the liquid to

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the surface layer so that the surface area is increased one square centimeter, is the unit of measurement of surface tension. This force is expressed in dynes per square centimeter.

If the drop under consideration is an oil and it comes to rest on the surface of another liquid, such as water, a slightly different condition will exist. In this case, the oil may spread out over the surface of the water, forming a thin film, or it may remain in the form of a flattened sphere, without any spreading occurring. If such a flattened drop is studied, it will be found that the surface of the upper portion of the oil is in contact with air and will exhibit the surface tension previously mentioned. The lower surface of the drop is now in contact with the water, and a molecule in its surface is pulled toward the oil by the attraction of the oil molecules and also toward the water by the molecules of the water. Here again a certain tension known as the surface tension exists at the oil-water interface and will be referred to as the interfacial tension. The part of the surface of the water not covered by the oil, is in contact with the air and will exhibit a certain tension, the surface tension of the water. In such a case the two liquids will arrange themselves in such a manner that the total free surface energy, that is, the sums of the surface tension of the oil, the surface tension of the water, and the interfacial tension of the oil and water will be reduced to a minimum. This statement may be made clearer by an example.

The unit of measurement of surface tension is dynes per square centimeter, hence if the surfaces considered in the illustration are limited to one square centimeter or a multiple thereof, the free surface energy in each case will equal the surface tension or a multiple of it. Imagine a vessel of water in which the surface exposed to the air is exactly two square centimeters. Place upon its surface just enough benzene to exactly cover one square centimeter of the water's surface. The surfaces of the whole system will then be one square centimeter of water in contact with the air, one square centimeter in contact with the benzene layer, and one square centimeter of benzene in contact with air. The total free surface energy would then be represented by the sum of these surface tensions and interfacial tension.

First condition—Total Surface Energy = Sur. Ten. Water + Sur. Ten. Benzene + Inter. Ten. Benzene-Water.

If, however, the benzene is spread out so that it covers the total surface of the water, only two surfaces will be exposed, namely, two square centimeters of benzene exposed to air and two square centi-

meters of water in contact with the benzene. The total free surface energy is then represented by twice the surface tension of the benzene and twice the interfacial tension, since in each case two square centimeters of surface are exposed.

Second condition—Total Surface Energy = 2 Sur. Ten. Benzene + 2 Inter. Ten. Benzene-Water.

The question as to whether the benzene will completely cover the water or only one square centimeter of its surface will depend upon which of these equations gives the smallest sum, or in other words which arrangement shows the least free surface energy. In this particular case the values of the surface tensions are known and may be given as an illustration. Substituting in these equations the values of surface tensions of pure benzene and pure water, the following is obtained.

First condition—Total Surface Energy = 72.05 + 28.17 + 34.68
= 134.9 dynes.

Second condition—Total Surface Energy = 2(28.17) + 2(34.68)
= 126.7 dynes.

It is thus seen that in this particular case the second equation, that is, where benzene is spread over the total surface of water, gives the smallest value for the free surface energy; and in actual experiment pure benzene will immediately spread over pure water.

If, however, the water has been in contact with benzene for a short time the values are changed, since the surface tension of the water is reduced by the benzene dissolved in it while the surface tension of the benzene is reduced by the water dissolved in the benzene and the interfacial tension is increased. Substituting these new values in the equations the following are obtained:

First condition—Total Surface Energy = 60.19 + 27.90 + 44.68
= 132.77

Second condition—Total Surface Energy = 2(27.90) + 2(44.68)
= 145.16

The first condition represents the smallest sum and the benzene will collect in the form of a drop on the surface of the water rather than as a film over its whole surface. In an actual experiment, when pure benzene is spread over the surface of pure water, it will be observed that after a period of time sufficient for the water to dissolve some of the benzene and the benzene to dissolve some of the water, the

benzene film pulls together, forming a flattened drop on the surface of the water.

These equations may be simplified and generalized by allowing A to stand for the surface tension of the liquid upon which the second liquid, B, is placed. The interfacial tension can then be considered as AB. The general formulae may be expressed as

$$A + B + AB$$
and $$2B + 2AB$$

Subtracting the 2nd formula from the first, the expression A—B —AB or $A + (B + AB)$ is obtained. It is easy to see that if this result is positive, spreading will occur, while if negative the liquid, B, will collect in the form of a flattened drop. In short if $A > B + AB$ spreading will occur while if $A < B + AB$ spreading will not occur.

Turning to the actual conditions of spraying it is found that A represents the leaf surface while B is the spray, hence if the surface tension of the leaf is greater than the sum of the surface tension of the spray and the interfacial tension at the spray-leaf surface, spreading will occur; while if less, the spray will collect in the form of a drop and roll off the leaf. Altho it can not be proved that solids have a surface tension, all evidence tends to show that they do have a high surface tension which can not be measured owing to the immobility of its molecules. Since the surface tension of the leaf will remain constant, spreading must be obtained by influencing the surface tension of the spray or the interfacial spray-leaf tension. Lowering both or either of these surface tensions until their sum is lower than the surface tension of the leaf will produce a spray which will spread over the leaf surface.

The first question arising is how can surface tension be lowered? Some substances dissolved in water will tend to concentrate in the interior of the liquid, so that a unit volume of the interior of the liquid will possess more of substances than a unit volume of the surface layer. Most inorganic substances, such as sodium chloride, copper sulphate, etc., show this character. These substances, having a strong tendency to move away from the surface layer, will require even a larger force to bring them into a surface. The surface tension of water is therefore increased by the addition of such substances. The surface tension of water at 20 degrees C. is 72.8 dynes, while a salt solution of a density 1.193 at the same temperature has a surface tension of 85.8 dynes.

Just as there are substances which tend to concentrate in the interior there are other substances which tend to concentrate in the surface layer. These materials are considered as being positively adsorbed in the surface as distinguished from the above negatively adsorbed substances. Having molecules with a tendency to move to the surface, less force will be necessary to bring them to the surface and the surface tension is reduced. Soap, proteins, and various organic substances exhibit this character of positive adsorption. A saturated solution of soap (sodium oleate) at 20 degrees C. has a surface tension of 25 dynes as compared with water with 72.8 dynes.

It is not always practical to produce spreading of a spray over the surface of a leaf by lowering the surface tension alone. The interfacial tension must also be lowered. To solve this problem substances must be selected which will be positively adsorbed at the leaf-spray interface.

It has been shown that when one liquid, such as oleic acid, is placed on the surface of another liquid, such as water, the active portion (COOH group) of the oleic acid molecule will be attracted by the water molecules while the portion rich in carbon groups will be turned away from the water. When three materials are used, such as oleic acid dissolved in a mineral oil and the oil placed on the surface of the water, the oleic acid will be adsorbed at the oil-water interface, the portion of the molecule similar to the oil being found in the oil while the active COOH group is attracted to the water. This arrangement results in the lowering of the interfacial tension, and the mineral oil will spread over the surface of the water. Applying this to a spray on a waxy surface such as that of cabbage, it would appear that a substance should be dissolved in the water which will have active groups such as COOH, CO, CN, OH, $CONH_2$ to render it soluble in the water, and carbon groups similar to the molecule of the wax. Such a substance would be attracted to or positively adsorbed at the leaf-spray interface thus lowering the interfacial tension. Such organic substances not only lower the interfacial tension but also the surface tension of the spray to a certain extent, hence they maintain the spray in the form of thin film on the leaf surface. Such was found to be the case. Saturated aqueous solutions of amyl alcohol, benzyl alcohol, beechwood, creosote (cresol and guaiacol) carvacrol, and eugenol gave spreading over cabbage leaves.

Leaves with a heavy cuticle, such as citrus or pear, consist largely of celluloses and not wax. It is therefore not surprising that these aqueous solutions or organic compounds do not cause spreading on

these leaves. Applying the same principles, it was found that substances somewhat similar to the cellulose, such as casein, gelatin, flour, starch, saponin, and even leaf extracts or infusions gave good spreading. Sprays of this type did not spread on waxy leaves unless driven with such force that the spray was brought into contact with the cellulose epidermis beneath the bloom.

CONTRIBUTION TO THE KNOWLEDGE OF THE GROUP APHIDINA, FAMILY APHIDIDAE (HOMOPTERA)

By O. W. Oestlund

In a previous contribution[1] the tribes of the group Aphidina were left rather bare with the intention of treating these important tribes in a later contribution in connection with the genera and species found in Minnesota. The following contribution will be a partial fulfillment of these intentions but without consideration of the genera and species. A number of side questions have repeatedy come up in connection with the more strictly taxonomic work to which it appears timely to give some special attention. They may not all be closely connected with the subject in hand, but are digressive discourses on phylogenetic subjects suggested by the main topic. To some they may appear critical; they have not been written with this intention, but rather to be suggestive and helpful towards placing the taxonomy of the family on strict phylogenetic foundations. The time is rapidly passing when individual opinions will have much weight or value unless they rest on broad phylogenetic principles.

Group APHIDINA (Mordwilko) Oestlund, 1919

Linnaeus, 1758. Syst. Nat. Ed. X. Sub Aphis (genus)
Burmeister, 1835. Handb. Entom. Vol. 2. Sub Aphidina (family)
Koch, 1854. Die Pflanzenl. Hft. 1. Sub Aphiden (tribe)
Passerini, 1863. Aphid Ital. Sub Aphidinae (subfamily)
Buckton, 1876. Monogr. Vol. 1. Sub Aphidinae (tribe)
Thomas, 1878. Bull. 2, Ill. State Lab. Sub. Aphidini et Siphonophorini (tribes)
Oestlund, 1887. Bull. 4, Geol. Surv. Sub Aphidini et Nectarophorini (tribes)
Mordwilko, 1908. Acad. Imper. Vol. 13. Sub Aphidina (group)
Wilson, 1910. Ann. Ent. Soc. Am. Vol. 3. Sub Aphidini et Macrosiphini (tribes)
Van der Goot, 1913. Tijdschr. Entom. Vol. 56. Sub Siphonophorina (tribe)
Oestlund, 1919, 17th Rept. State Entom. Minn. Sub Aphidina (group)
Baker, 1920. Bull. 826, U. S. Dept. Agr. Sub Aphidini (tribe)

The bibliography above, tho incomplete, will suffice to show the progress and trend of thought in establishing the higher categories for the family. Considerable confusion and differences of opinion still exist in regard to the proper use of the categories.

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1 "Contribution to Knowledge of the Tribes and Higher Groups of the Family Aphididae (Homoptera)" Seventeenth Report State Entomologist of Minnesota, 1918, pp. 46-72.

Koch was the first to recognize tribes and arranged the thirty genera then known into twelve tribes, but unfortunately left no descriptions of them and they remain as *nomena nuda*. In a previous contribution we attempted to interpret them as far as possible and give Koch the credit we can, by the recognition of his thoughts in our bibliographies, at least. Passerini (1863) first recognized subfamilies and submerged the tribal thoughts of Koch. Buckton (1876) made use of the subfamily terms of Passerini in a tribal sense. Thomas (1878) used the tribal endings and recognized the two tribes Aphidini and Siphonophorini. Mordwilko (1908) first recognized groups of tribes and gave the term Aphidina to the group under consideration. Mordwilko was not always clear in the use and distinction between tribe and group and sometimes uses the group term in the sense of tribe. Van der Goot (1913) recognized twelve tribes but makes use of Mordwilko's group endings and gives the group under consideration as Siphonophorina. Oestlund (1919) gave the group divisions higher than tribe in the sense of Mordwilko, of which Aphidina is one. Baker (1920) goes back to the tribal division, not recognizing the group, and reduces the number of tribes in the family to fifteen.

That we have a score or more tribes in the family appears now to be well understood and recognized. Arrangement of the tribes into groups follows naturally from the attempt to trace their inter-relationship. Such groups are not necessarily supertribes tho eventually they may work out as such. In the present stage of knowledge they had better be considered as supplementary categories whose full status is not yet clear. Mordwilko seems to have used them in this sense. They appear rather to represent epochs or periods in the evolution of the family, as may be seen from the following arrangement of the tribes of the subfamily Aphidinae:

IV. APHIDINA	Aphidini	Myzini-Macrosiphini	
	*	*	*
	*	*	*
III. CALLIPTERINA	*	Calaphidini	
	*	*	Callipterini
	*	*	Drepanosiphini
II. CHAITOPHORINA ...	Pterocommini	*	
	* Chaitophorini	*	
	* Vacunini	*	
I. LACHNINA	Lachnini	Pterochlorini	

The Lachnina are represented by two or more generalized tribes of the family. Following this is the group Chaitophorina, easily traced from the Lachnini by way of the Pterocommini. The Chaitophorini being a parallel line from the same source; the Vacunini may be looked upon as a very specialized line, but of much interest as giving us a clew to the origin of the subfamily Pemphiginae. The Callipterina are a third group of tribes traced not from the Lachnini, but from the Pterochlorini stock, through the generalized tribe Calaphidini. The Callipterini and Drepanosophini stand in similar relation to the Calaphidini that the Chaitophorini and Vacunini do to the Pterocommini. What may be called the modern or recent group of tribes, represented by the term Aphidina, are the tribes rich in genera and species in which the family has reached the maximum of evolution of the present. The Lachnina represented the maximum of the family during the early days of its existence, and is now a declining or vanishing group few in genera and species in comparison with the rest of the family. During a somewhat later period, the two groups Chaitophorina and Callipterina flourished side by side, but were of very different origin and lines of development. And lastly comes what was just called the modern or recent group of tribes, the Aphidina, the peak of the family as represented at present. The groups are not, therefore, arbitrary terms expressing personal opinions, but are the outcome of extended biological and morphological studies carried on by Mordwilko and the author in the nineties, unknown to one another but leading to almost identical results. When Mordwilko, therefore, published his results, they were at once recognized by the writer, and have only been carried a step further. The group Aphidina includes the three tribes Aphidini, Myzini, and Macrosiphini. A key to the tribes was given in a previous contribution.

Tribe APHIDINI (Thomas) Oestlund, 1919

Koch, 1854. Die Pflanzenl. Hft. 1. Sub Aphiden (tribe)
Passerini, 1863. Aphid. Ital. Sub Aphidinae (subfamily)
Buckton, 1876. Monogr. Vol. 1. Sub Aphidinae (tribe)
Thomas, 1878. Bul. 2 Ill. State Lab. Sub Aphidini (tribe)
Oestlund, 1887. Bul. 4, Geol. Surv. Sub Aphidini (tribe)
Wilson, 1910. Ann. Ent. Soc. Am. Vol. 3. Sub Aphidini (tribe)
Van der Goot, 1913. Tijdschr. Entom. Vol. 56. Sub Siphonophorina (tribe)
Oestlund, 1919. 17th Rept. State Entom. Minn. Sub Aphidini (tribe)
Baker, 1920. Bul. 826 U. S. Dept. Agr. Sub Aphidina (subtribe)

It will be seen from the above synopsis of the bibliography of the tribe Aphidini that the conception of the tribe has varied

greatly from the time of its first recognition by Koch to the present. Koch's conception of the tribe included the Chaitophorina and the Macrosiphini. Passerini (1863) submerged the tribal conception and erected the subfamily Aphidinae of much wider extent that that of Koch's tribe. Buckton (1876) uses the subfamily term of Passerini in a tribal sense. Thomas (1878) first used the tribal term Aphidini but included the Chaitophorina and Callipterina. Oestlund (1887) excluded the Chaitophorina and Callipterina, in which sense Wilson (1910) also makes use of the term. Van der Goot (1913) gives the tribe under the term Siphonophorina, including also the Myzini and Macrosiphini. Baker (1920) reduces the tribe to a subtribe under the term Aphidina.

A tribe is a group of genera that can be traced from a common origin and which have certain characters in common. Tribes are not arbitrary divisions, but are the expression of phylogenetic relationship of a higher order and wider extent than those of genera. They will appear from extended biological and anatomical studies. Tribes are not safely established on too limited or arbitrarily chosen characters, but their test comes with the application of a number of additional characters which will build up into a harmonious whole. Tribes are also expressions of distinct lines of development separating them from other lines or tribes. Such lines may also run through two or more tribes expressing a still higher relationship. We have two such greater lines within the subfamily Aphidinae, which stand out sharply when attention once is directed to them. The two lines may be termed the Pterocommini-Aphidini line and the Calaphidini-Myzini line, and closely associated with the second the Calaphidini-Macrosiphini line. The two lines may also be distinguished as the small and large race: the first with shorter body, more rounded or abruptly pointed posteriorly; shorter antennae and legs. The second is of larger size but of more slender body-form and gradually pointed posteriorly; the antennae and legs are usually very long in comparison. This is a curious fact, but runs more or less distinctly through the whole family. Analogous conditions are not rare in other groups of animals. Some of the more conspicuous morphological characters besides those just mentioned are the conspicuous presence of lateral tubercles in the first line, while the same are usually inconspicuous or absent in the second line. Attention has often been called to these structures by investigators of the family, from the time of Kaltenbach to the present. Van der Goot has lately used them as generic characters in his at-

tempt to break up the large genus Aphis. The lateral tubercles as rudimentary organs have very great phylogenetic value, but are of little use as generic characters. In early work on the family the author also attempted to use them as a basis for generic characters in the old genus Aphis, but soon came to see that they led only to artificial groups that would not harmonize with other characters present. Lateral tubercles when found in full number are present on the prothorax and the first seven segments of the abdomen. Koch recognized a series of species within the genus Aphis as Pleurodonten, which evidently were forms with full or a large number of tubercles present. The number is more commonly reduced; we have a very large series of the genus Aphis with only three, the prothoracic, one anterior abdominal, and one posterior abdominal. The abdominal will in turn disappear leaving only the prothoracic, the last and most persistent of all the tubercles. Lateral tubercles in a more or less rudimentary condition are now known for practically all the tribes of the family, and they may be looked upon as originally characteristic of the family, but appear now as rudimentary organs that are gradually becoming lost. Their persistence and conspicuous presence in the tribes Pterocommini and Aphidini are therefore significant as indicating the close relationship between these two tribes. The characters are too broad to be applied to genera, where they at most would indicate the degree of reduction that has taken place, which varies greatly for different tribes and groups.

A single or even a series of arbitrarily chosen characters will lead to more or less artificial results. The same may give the phylogenetic evolution of the organ or organs in question but not necessarily that of the organism. The value of a given character must be ascertained for each group separately. While a given character may have very great value for a certain group, the same character may have little or no value for a closely related group. The series of characters that we may make use of are therefore not the same for all, but will differ in their arrangement and values for the different groups, be this a species, genus, tribe, etc.

The primary aim of classification is not the arrangement of forms in convenient groups by which the name can readily be ascertained, important as this is from a practical point of view; if this were so we might as well at once accept the numerical or a Dewey system and have each category fixed once for all, as has more than once been suggested and attempted in the history of taxonomy. The aim is to express the true phylogenetic relationship of the various categories to

one another; how the family Aphididae grew or developed into the large, complex, and interesting form that it now presents to us. We aim to trace the various lines of progress, sometimes retrogression, found within the family, lines that are constantly diverging but converge as we approach their origin. The fundamental characters are therefore not structural but physiological and ontogenetic, or, in short, biological, as phylogeny is essentially an extended ontogeny. Such characters are not easily grasped and understood, and in most cases can only be expressed as these same characters have expressed themselves in the modified structural. Morphology becomes in this respect the language of phylogeny. Moreover we should be careful that we express the spirit of this language and not allow it to become a dead and artificial language.

The Pterocommini-Aphidini line has also expressed itself in another character easily seen and very important in placing the tribe Aphidini. The sensilla, or sense hairs, on the antennae, the head, and sometimes also other parts of the body, are here simple or hair-like, not differing much from ordinary hairs except that they have a direct nervous connection. This type is characteristic of the Pterocommini as well as other tribes of generalized Aphidinae. In the Aphidini they are usually short, sharply pointed, spine-like structures very characteristic of the group. In the Calaphidini-Myzini line the sensilla are enlarged apically, globate, capitate, and glandular, which is also true of the Calaphidini-Macrosiphini line, tho with a distinct form of the enlarged apex. The globate sensilla seem to have a wider distribution and are often found in the larval forms even more conspicuous than in the adult. Such characters may be looked upon by some as too minute and difficult for practical purposes, but the phylogenist does not consider the difficulty of a character, provided it aids him to grasp the true state of affairs. We may consider ourselves fortunate in having to deal with a group so rich in external characters which have not become exhausted, rather than with one in which we have to turn to internal, dissected characters, as is already required in more than one of the more difficult groups of insects.

The antennae and sensoria also show some interesting differences in the two lines under consideration. In the first line they are usually shorter than the body tho showing a progressive increase in length from the Pterocommini and throughout the Aphidini; the spur of the terminal segment is always well developed in comparison with the short condition in the Lachnini. In the second line the antennae usually surpass the body in length and the spur also reaches exceptional

lengths. With the increase of the antennae we also find a corresponding increase of the antennal or frontal tubercles. Van der Goot has shown that they have little value in distinguishing genera and are present in the Aphidini as well as in the Macrosiphini; they are also found in the Calaphidini.

The Aphidini may be divided into two subtribes, the Aphidii and Hyalopterii.

KEY TO THE SUBTRIBES OF THE APHIDINI

1. Cornicles usually much longer than broad, cylindrical, sometimes wider at base and tapering, or distinctly swollen. A direct Pterocommini line. . . . APHIDII
2. Cornicles short, usually not longer than broad, when longer than broad they are usually slender and narrowed at base. Indicating Chaitophorini characters in addition to the usual Aphidini. . . . HYALOPTERII

A division or grouping of the genera of the Aphidini was suggested by Baker (1920), and historically was expressed by Koch in separating the genera Rhopalosiphum and Hyalopterus from the old genus Aphis. Two of these are undoubtedly distinct lines or sublines and so express a subtribal division, but this can not be said of the third, tho it appears so. The Aphidii with cylindrical cornicles and progressive increase of length within the division indicate a distinct line from the Hyalopterii with their short cornicles, non-progressive increase of length in which they agree better with the more primitive Chaitophorini. Some of the Aphidii may have cornicles very short or even wanting, but this can be shown to be a reduction (retrogression) from the original longer type of the division. The enlarged or swollen character of the cornicles in Rhopalosiphum and related genera would at first appear to have similar value, which is not the case. Swollen cornicles are not confined to the Aphidini, this condition is common also in the Pterocommini and can be found in the Calaphidini; it is found in the Macrosiphini and is almost characteristic of the Myzini as a tribe. Koch's genus Rhopalosiphum has given more trouble and led to more misplacement of species than all the other genera put together. Swollen cornicles is apparently a character that early cropped out in the primitive stock from which the group Aphidina is derived, and the same character has again repeatedly cropped out in the various tribes of the group. It is an excellent generic character when the various types of swellings are considered. At most the group can be considered as a section in the Aphidii.

It will be noticed from the bibliography of the tribe that Baker (1920) considers it as a subtribe under the term Aphidina. Whether it is considered as a tribe or subtribe is of minor importance, but

I strongly object to the use of the ending -ina in a subtribal sense. The ending -ina may have the stamp of the Entomological Code, but it is ill-advised and contrary to good usage in nomenclature, as attested by the best writers for a century or more. The term ending -ina has always been used with the idea of something higher or supra, and not as sub, following the spirit of the Latin language which is the language of nomenclature. For subdivisions of the tribe with ending -ini, the best writers of the past have used the ending -i or -ii. Now to replace this by an arbitrarily chosen ending is contrary to good usage, which after all is a higher law that it is not well to go contrary to. Mordwilko, therefore, in recognizing groups higher than tribes, very correctly used the ending -ina in accordance with good usage. This was accepted by the author in a previous contribution in an endeavor to establish this category in the family, as far as this can be done in the present state of knowledge of the family. This may be a minor question, but good authors of the past have always been particular in this respect, guarding against corruption of good usage of the language.

Tribe MYZINI Oestlund, 1919

Passerini, 1860. Gli Afidi. Sub Myzus (genus)
Oestlund, 1919. 17th Rept. State Entom. Minn. Sub Myzini (tribe)

The present tribe was first indicated by the author. An elaboration of the grounds that led to this step may therefore properly be considered here. Passerini first foreshadowed the tribe in separating off the genus Myzus. Much confusion exists as to the proper place of the genus, and with the increase of genera has rather increased than diminished. The genus Myzus has usually been associated with the Macrosiphini with which it has much in common.

The presence of a peculiar type of sensilla on the antennae and head, and usually on a large part of the body, present not only in the adult form but also in the larval, is not only conspicuous but a character that must be accounted for phylogenetically and the taxonomic value of these sensilla established. We may ignore them as we have in the past and consider them as curious structures of little value, but then we must show that they really are such. There are three types of sensilla in the family Aphididae: first, the generalized hair-like sensilla of the Lachnina and Chaitophorina; second, the glandular or capitate sensilla so characteristic of the Callipterina and continued in the tribes Myzini and Macrosiphini; third, the spine-like

sensilla of the Aphidini, in which tribe the type seems to have arisen. Sense organs are generally recognized to be of exceptional phylogenetic values and are much used in taxonomy. To be sure we know next to nothing about their functions, in insects at least. They are very conveniently ignored, but if we persist in ignoring them our ignorance will only continue as to their functions. If we can do no more than call attention to these structural differences as they can easily be seen, this may be a first step leading to the examination of their histology and later by experimental methods should lead to some clew as to their various functions and phylogenetic values. We do not ask for excuse for bringing in a troublesome question that may lead to re-examination of much of the work of the past.

The genus was first erected on characters drawn from the frontal tubercles and the first antennal segment. The frontal tubercles have bulges or swellings on the inner side causing them to approach and restrict the concavity between them. The swellings are more noticeable in the larval forms than in the adult and carry the usual number of sensilla. The reticulations on these swellings are very sharp and conspicuous and may be the cause and significant function of these structures. Indications of similar swellings are to be found in both the Aphidini and the Macrosiphini, but never so conspicuous as to draw special attention. Those on the first antennal segment are similar in structure and are probably but an extension of the first. What the functions of these structures are we do not know, but their conspicuous presence coupled with other distinguishing characters enables us readily to distinguish the tribe from those closely related.

The cornicles are usually very long and slender, reticulation broken as in the Aphidini; often with swellings on apical half, sometimes confined to one side. Considerable variation in form of the cornicles is seen, and an extended study may lead to a better understanding of the internal relations of the species and genera than we at present possess. The tribe is a small one in comparison with the preceding and at present no indications of a subdivision have been noticed.

Tribe MACROSIPHINI (Sanborn) Oestlund, 1919

Koch, 1855. Die Pflanzenl. Hft. 5. Sub Siphonophora (genus)
Passerini, 1860. Gli Afidi. Sub Macrosiphum (genus)
Thomas, 1879. 8th Rept. State Entom. Sub Siphonophorini (tribe)
Sanborn, 1904. Kas. Aphid. Sub Macrosiphini (tribe)
Wilson, 1910. Ann. Ent. Soc. Am. Vol. 3. Sub Macrosiphini (tribe)
Van der Goot, 1913. Tijdschr. Ent. Vol. 56. Sub Siphonophorina (tribe)
Oestlund, 1919. 17th Rept. State Entom. Minn. Sub Macrosiphini (tribe)
Baker, 1920. Bul. 826, U. S. Dept. Agr. Sub Macrosiphina (subtribe)

The present tribe found its first conception in the genus Siphonophora of Koch (1855). Thomas (1879) recognized the tribe Siphonophorini of very heterogenous composition including the Myzini. Sanborn (1904) and Wilson (1910) give the term Macrosiphini with inclusion of the Myzini. Oestlund (1919) restricts the Macrosiphini by the exclusion of the Myzini. Baker (1920) considers it as a subtribe under the term Macrosiphina including also the Myzini.

The present tribe has for some time been recognized as distinct from the Aphidini, but more or less obscured by the inclusion of the Myzini. When the Myzini are excluded the tribe stands out as one sharply defined and supported by a long series of distinguishing characters. A character of first importance is the sensilla in accordance with the two previous tribes. The Macrosiphini, to be sure, have apically enlarged sensilla with the Callipterina and Myzini, but here they are never globate. Rather, they are spoon-like or spear-like, widening at the apex, which is more or less pointed like a spear, indicating a modified type or line of origin; in some cases the widening of the tip may not be apparent, and they are finger-like with a rounded apex. We trace them from the Calaphidini, the same as the Myzini, but from a different stock from which they derived their distinctive type of sensilla as well as other characters not found in the Myzini and Aphidini. The size and type-form of the body is distinctive and found again in the Calaphidini, some of which in the field would easily be mistaken for a Macrosiphum if we did not notice the cornicles. The legs and antennae are long and slender, the spur of the terminal segment reaching its greatest length here. The secondary sensoria of the spuria are very persistent and are usually found on the third segment, while in other tribes their presence is very exceptional. The cornicles are usually very long and cylindrical, sometimes wider at the base, and sometimes distinctly swollen; the reticular lines of the apical part are retained very sharp and distinct, the lines forming polygonal areas or cells of various size and number. In swollen cornicles these areas may be very much restricted, forming a ring just below the rim. In some with comparative short cornicles, the reticulation may be broken, as in the Aphidini. The cauda is also a very distinct form, often referred to as the principal characteristic of the genus Macrosiphum, being rather thick at the base, then somewhat suddenly narrowed and turned upward. The narrow portion may be looked upon as an extension of the original thick and blunt cauda of the Calaphidini. The venation is very constant and uniform except in a second division or subtribe where the venation is variable, inconstant, and

excentric. Two divisions or subtribes may be distinguished, the Macrosiphii and Pentalonii.

KEY TO THE SUBTRIBES OF THE MACROSIPHINI

1. Venation normal; cornicles cylindrical or swollen, and usually with closed reticulations on the apical part; spuria usually with sensoria on the third antennal segment. . . . . MACROSIPHII
2. Venation reduced, abnormal or excentric; cornicles also show a tendency to lose their distinctive Macrosiphini characters. . . . . PENTALONII

What was said about the swollen cornicles under the Aphidini also holds true here. The Macrosiphii and Pentalonii undoubtedly represent two distinct lines and are good subtribes, while Amphorophora and related genera would seem to indicate a third line, which it does not prove to be; at most it is a section under the Macrosiphii.

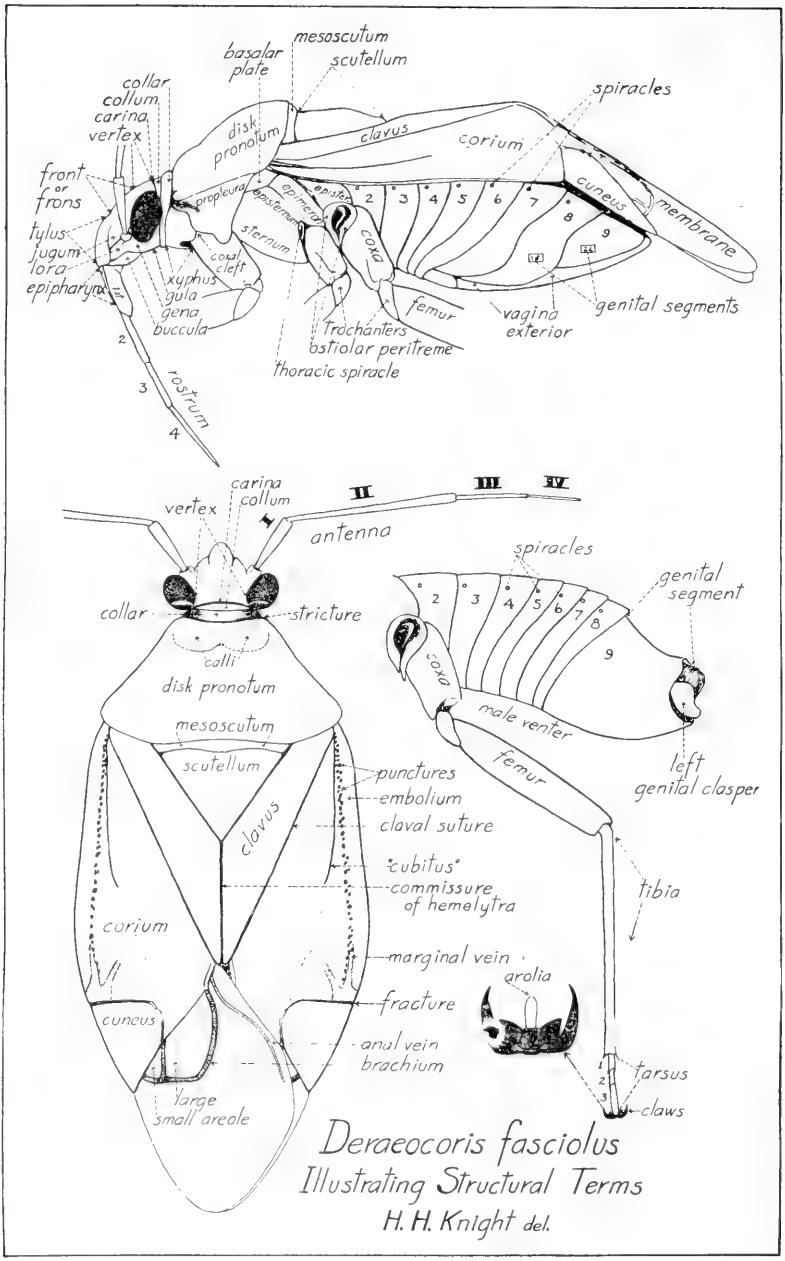
The tribes Aphidini and Macrosiphini give us two of the largest genera of the family. From the old genus Aphis we have carved genus upon genus for nearly a century and attempts are still made to carve additional genera out of it. It appears that we have about come to the limit, as some of the later attempts are plainly artificial. Considering the relative length of the cornicles and cauda will, to be sure, give us genera, arbitrary and artificial genera but not genera as found in nature. The genus Aphis even as it stands today is too large and unwieldly, and reduction would be desirable. A number of small, abortive, genera will no doubt continue to be separated off, similar to Toxoptera, Mastopoda, and Hysteroneura, but attempts to break up the genus as a whole can not be made without destroying the generic conception or resorting to artificial divisions. Large genera are not uncommon and are to be found in most of the large families of plants as well as of animals, and the Aphididae can now be considered as a large family. The two comparatively modern genera, Aphis and Macrosiphum, are the ones in which the rate of evolution has reached its maximum, and they have become rich in species above comparison and contain the principal progressive parts of the family.

A great deal of attention has been given of late to the question of types. Some of the more recent contributions would seem to imply that this is the main purpose and aim of taxonomy, and with the setting of a type we have the genus once for all fixed and it can not again be changed. There are three kinds of types recognized by phylogenists, which may be termed the chronological type, the phylogenetic type, and the biological type. The chronological type is the one in vogue at present. It is usually the oldest species included in the genus, or any species that happens to be considered as type by the author of the genus. Two or more different types may be set for a

genus. Such types are important in settling questions of priority, or the status of the genus as used differently by various authors. Important as such types are, at least in the present stage of taxonomy, the chronological type is really the least important of the three, and will in due time largely be replaced by the second and used only in its strict historical sense. The phylogenetic type is the real type of the genus. Such types can not be set arbitrarily, and can be recognized only by an extended study of all the species of a genus. It is the species that carries all the generic characters in fullest development. As types like this can not be set without taking into consideration all the species of the genus, the monographer of the future, it is hoped, will set such types for the genera which will be the real phylogenetic types, replacing, at least in many cases, the chronological type which is often far from typical, being more often an extreme form that happened to be first described or set as type. The older entomologists often spoke about typical species, vaguely to be sure as was necessary with the incomplete knowledge of the family in their time. At present we rarely find this idea expressed, and the only type worth considering seems to be the chronological type leading more and more to an artificial taxonomy, and not to the true phylogenetic as we find it in nature. The biological type is better known and recognized, but we too often speak and write as if it was already in our possession, which is far from the case. Each species is potentially a biological type, or eventually will become one. Too many of our species are only partial or fragmentary types based on a single form, usually the migrant, and expressed by a few apparent differences. The biological type in the family Aphididae is a very complex thing not easily ascertained or grasped. It includes in most cases at least five or six distinct forms, the fundatrix, spuria, migrant, and male and female, of which the one is no more important than the other, but all must be considered and fused into a whole, the biological species or type. Much good work has been done of late in this direction, but much more remains to be done before we can safely begin to settle the final status of the various categories.

The taxonomy of the Aphididae is a fascinating subject and has attracted an unusually large number of devotees for a century or more, some of a very high order of mind. It is a field not safe for the novice to enter with impunity, as many of the best, who spent a good part of their lifework in the field, still considered themselves as novices, and felt their way with caution, trying to grasp the outline and some faint idea of the grandeur of the phylogenetic conception of the

whole as it gradually began to dawn upon them. It is yet incomplete, many important parts are still lacking, and much obscured by temporary outside additions and rubbish. These in due time will be cleared away and the building will stand out in all its splendor—the taxonomy of the Aphididae. After all, this will be but a faint imitation or interpretation of the phylogeny of the Aphididae, a part of the still greater, the organic evolution as erected during the periods of the past.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collar
stricture
calli
disk pronotum
mesoscutum
scutellum
clavus
corium
cuneus
large areole
small areole
punctures
embolium
claval suture
"cubitus"
commissure of hemelytra
marginal vein
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anal vein
brachium
areolia
spiracles
genital segment
coxa
male venter
femur
left genital clasper
tibia
tarsus
claws
Deraeocoris fasciolus
Illustrating Structural Terms
H. H. Knight del.

Plate VIII.

MONOGRAPH OF THE NORTH AMERICAN SPECIES OF DERAEOCORIS (HETEROPTERA: MIRIDAE)[1]

By Harry H. Knight

The genus Deraeocoris now includes all those species which have been described under Camptobrochis. Largely through the labors of Reuter and Poppius the genus is now known to have a world-wide distribution, ninety-three species and forty-three varieties being listed from parts other than the Nearctic region. In the present paper the writer has been able to recognize fifty-four species and twenty-two varieties from North America, of which *D. ruber* (Linn.) is common to both Nearctic and Palearctic regions, making a total of one hundred and forty-six species and sixty-two varieties from the world. Thirty-seven species and twenty varieties are herewith described as new.

Very little has been published regarding the life history and economy of these insects and in fact the species have been very imperfectly known. The writer has given special attention to the genus Deraeocoris during six seasons of collecting, and as a result, has been able to associate with definite host plants all but two of the known eastern species as well as certain of those found in the southwestern states. In several instances this relation appears to be more dependent on the predaceous habits of the bugs which feed largely on the aphids found on particular hosts, rather than the sap from the plant. In fact the writer has not detected a single case where the bugs have fed on the foliage of a plant and produced the characteristic leaf-bug injury which is always to be seen on plants infested by true leaf-feeders. The general scarcity of these insects as compared with leaf-feeding species is only another indication of their predatory habits, for predaceous forms never attain great abundance except sporadically in favored spots.

In the case of several species of Deraeocoris, if nymphs or adults are caged with succulent growth of the host plant, the bugs manage to live on sap alone but appear to prefer plant-lice or other small soft-bodied insects when such are available. Dr. W. H. Wellhouse has reared a specimen of *D. fasciolus* to the adult stage, the bug feeding only on the foliage of Crataegus, altho he found in rearing other specimens that aphids were fed upon when obtainable. The writer has found that *Deraeocoris aphidiphagus* feeds on *Schizoneura americana* Riley, while *D. nitenatus* feeds upon *Schizoneura lanigera* (of

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Patch) on the elm; *D. fasciolus* feeds on *Aphis sorbi* Kaltenbach of the apple, upon *Schizoneura crataegi* Oestlund on Crataegus, and upon *Phyllaphis fagi* (Linn.) of the beech. These species are perhaps the best known, but others present equally interesting biological aspects. Several of the species live on conifers where they appear to be associated with aphids and other small soft-bodied insects which infest such trees. *D. pinicola* feeds at least in part on the pine-bark aphid, *Chermes pinicorticis* Fitch, while *D. nubilus* occurs on the same tree and most probably has similar habits. *D. laricicola* apparently breeds only on larch, *Larix laricina,* and when caged on succulent growth was found to feed on sap of the plant, altho it may well be predaceous in part, when opportunity permits, as is true of several species in the genus.

The nymphs of Deraeocoris present at least two characteristic forms. One group comprises several species in which the nymphs are typically covered with a white, powdery, flocculent material, and are thus in the early instars, not readily distinguished from the aphids among which they live. Nymphs of a second group, represented by *D. albigulus, nigritulus, pilosus,* and related species, are distinctly hairy and not covered with the white powdery substance as the above mentioned forms. The first group is composed of species which are known to be largely predaceous while the second group may prove to be forms which are primarily phytophagous.

The life histories of the species present some interesting variations. The *nebulosus* group, or subgenus Camptobrochis, comprising most of the species with punctate scutellum, contains forms that are known to pass the winter in hibernation as adults. The species of this group which have most frequently been taken in hibernation are *D. nebulosus, nubilus,* and *cuneatus.* Such a cycle is not the mode of life for *D. grandis, aphidiphagus, betulae, pinicola,* and several other closely related species, for the writer has closely observed the disappearance of these insects at the end of their season and no pinned specimens have been noted which would indicate the contrary. Just how and where the eggs are laid are facts still awaiting investigation but the writer has repeatedly found the young nymphs of *D. aphidiphagus* in the curled elm leaves very soon after the leaf is rolled by the aphid *Schizoneura americana* Riley. The eggs are doubtless inserted in the buds or twigs of the tree and upon hatching the young nymphs probably travel about seeking until they find leaves which are infested by the aphids.

For the loan of material the writer is indebted to the authorities

of the United States National Museum, especially to Mr. E. H. Gibson and his assistant, Miss Emma Wells, who assembled all the Deraeocoris material from the collections contained there, including the Uhler types; to Dr. J. Chester Bradley for placing at the writer's disposal all the material in the Cornell University collection and the Heidemann collection now contained there; to Mr. E. P. Van Duzee for considerable material from the western states; to Mr. H. G. Barber, Dr. H. M. Parshley, Mr. Wm. T. Davis, Mr. J. R. de la Torre-Bueno, Mr. Chris. E. Olsen, Mr. W. L. McAtee, Dr. W. E. Britton, Prof. C. P. Gillette, Prof. C. J. Drake, Mr. W. J. Gerhard, Mrs. A. T. Slosson, Dr. C. P. Alexander for material from the Illinois Natural History Survey, and Dr. J. McDunnough for Canadian material. To these and to several other friends who have from time to time sent a few specimens, the writer wishes to express acknowledgment and appreciation.

GENUS DERAEOCORIS KIRSCHBAUM

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†*Capsus* Fieber, 1858, Wien. Ent. Monats., ii, p. 307.
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Walker, 1873, Cat. Het., vi, p. 42.
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Capsus (Camptobrochus) Thomson, 1871, Opusc. Ent., iv, p. 427.

Callicapsus Reuter, 1876, Ofv. Kongl. Vet.-Akad. Forh., xxxvi, p. 75. (Haplotype *histrio* Reut.)
Atkinson, 1890, Cat. Capsidae, p. 97.
Kirkaldy, 1906, Trans. Am. Ent. Soc., xxxii, p. 140.

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Shana Kirkaldy, 1902, Entomologist, xxxv, p. 315. (Haplotype *ravana* Kirk.)

Mycterocoris Uhler, 1904, Proc. U. S. Nat. Mus., xxvii, p. 358. (Haplotype *cerachates* Uhl.)

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Camptobrochys (Callicapsus) Van Duzee, 1917, Cat. Hemip., p. 354.

Camptobrochys (Mycterocoris) Van Duzee, 1917, Cat. Hemip., p. 355.

The genus Deraeocoris was founded by Kirschbaum in 1855 as a subgenus of Capsus (Authors) to include two new species and

thirty-nine previously described forms. Reuter (1875) removed nearly all the species which had been included by Kirschbaum, making the genus practically coextensive with Capsus of Fieber (1861), the latter author having failed to recognize Deraeocoris in his important work on the European Hemiptera. Distant (1904) named *olivaceus* (Fabr.) as genotype, while Kirkaldy (1906) to be more exact, named *medius* Kirschbaum (= *olivaceus* Fabr.) as type of Deraeocoris. A pseudotype, *ruber* (Linn.), was named by Oshanin (1912).

Reuter (1909) in a revision of the Nearctic species under the genus Camptobrochis, in substance expressed the opinion that he was very doubtful if Camptobrochis Fieber and Deraeocoris Kirschbaum are to be separated. It remained for Poppius (1912) in his great work on the African Miridae to definitely place Camptobrochis as a synonym of Deraeocoris. This conclusion was reached after that author had made a careful study of collections from every quarter of the globe, material which represented no doubt the greatest amount ever assembled. Mr. Van Duzee (1916) has indicated that Camptobrochis and Deraeocoris may be separated by characters found in the antennae and lateral margins of the pronotum. The writer would state that in the present work the number of North American species has grown until every variation from the cylindrical to clavate type of antenna is represented, likewise the carinate and ecarinate form of pronotum, there being a gradation of both characters so that among a few forms it is quite impossible to decide on that basis, into which group the species should be classed. The final outcome has been that a new set of characters has been brought forward in an effort to separate the genus into groups as indicated below.

After a considerable period of research for available characters in Deraeocoris, the writer has been able to separate the species into groups, one of which represents Camptobrochis as a subgenus, if we may have such, but in a much more restricted sense than has been the usage in the past. The species closely related to the genotype of Camptobrochis are chiefly distinguished by the punctate scutellum, spined character of the hind tibiae, a rather distinctive type of left genital clasper, and perhaps by the fact that the species hibernate as adults. In the North American fauna the group now includes *nebulosus* Uhler and ten other closely related species. Perhaps some workers would consider Camptobrochis as a genus on the premises submitted, but judging by a comparative study of tibial characters as found in the

other genera of the subfamily Deraeocorinae, Camptobrochis would appear to be only a part of the large genus Deraeocoris.

In an effort to settle the question regarding the proper name to use for our Nearctic species the writer has made an extended study of the possibilities for generic characters. In this work the one most constant character which appears to be distinctive throughout the large genus Deraeocoris is the arrangement of the spines on the front tibiae. In following the tibial characters it became necessary to refer elsewhere two species which have been recognized as aberrant in the genus, and with their removal a more satisfactory diagnosis may be drawn for Deraeocoris.

THE TIBIAL COMB

In making a survey for available characters in the Miridae the writer discovered an interesting structure in the form of a comb at the distal end of the front tibiae. To this the writer applies the name *tibial comb* for it is very similar to the comb-like structures well known on the legs of certain Hymenoptera. For the Miridae there appears to be no mention in the literature of such a structure on the tibia, the small size and inconspicuous nature of the comb doubtless accounting for this. The tibial comb lies at the distal end of the fore tibia and in the same plane as the anterior face, there being no differences between the sexes. The comb is composed of a single row of very fine, closely placed, translucent spine-like teeth, set on the very apical margin of the tibia, usually bounded dorsally by one or more thick dark colored spines and ventrally in the same manner, the exact number and arrangement being different for each genus within a related group (Pl. IX). The front tibia is always more or less flattened on the anterior face near apex and usually very distinctly sulcate, these modifications being well adapted for cleaning both rostrum and antennae. On a few occasions the writer has observed living bugs cleaning the rostrum and antennae by applying the front feet, one on each side of the member and combing from base toward apex; in such cleaning operations the tibial comb undoubtedly has an important function. The tibial comb is fully developed in all the fourth and fifth stage nymphs which have been examined. A cursory examination of species in other families indicates that the tibial comb is present in all the Heteroptera having well developed antennae. In certain species of Reduviidae the comb is situated somewhat before the apex of the tibia.

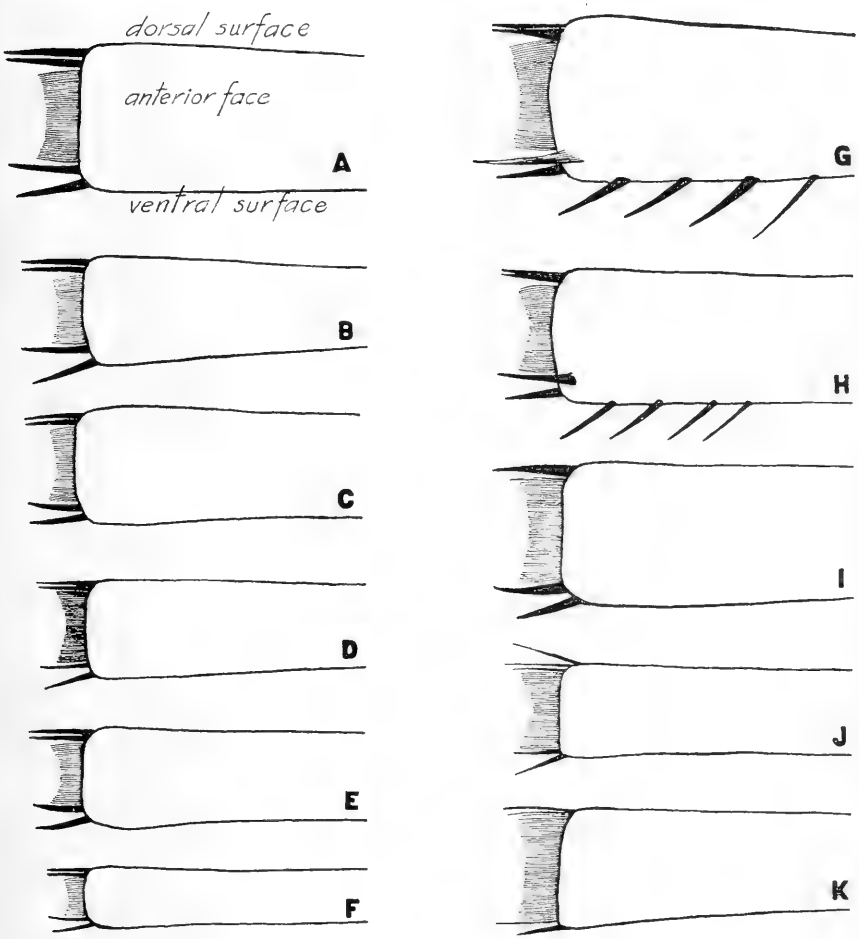

Plate IX. Illustrating the tibial comb and spines on the front tibiae of representative species of subfamily Deraeocorinae. A, *Deraeocoris olivaceus* Fabr.; B, *D. ruber* Linn.; C, *D. sayi* Reut.; D, *D. pinicola;* E, *D. grandis* Uhl.; F, *D. (Camptobrochis) nebulosus* Uhl.; G, *Deracocapsus ingens* Van D.; H, *Deracocapsus fraternus* Van D.; I, *Cimatlan grossum* Uhl.; J, *Eurychilopterella luridula* Reut.; K, *Diplozona collaris* Van D.

There appears to be little doubt that the spines, their form and arrangement on the tibiae, present characters which are correlated directly with a particular type of body structure, the combined elements of which are characteristic of small groups of species, or genera. Certainly the tibial spines are not specific in character but must pertain to a higher category. At present any statement regarding the general usefulness of tibial spines for distinguishing genera is of a preliminary nature, but in so far as the writer has carried his investigations it would appear that these characters will prove highly useful. In the Bryocorinae and Cylapinae the spineless character of the tibiae has been emphasized by Reuter, but to the writer it appears that the spines, their arrangement, or absence thereof, may be given more extended use, perhaps supplying additional and much needed criteria for distinguishing genera as well as certain larger groups within the family.

SUBFAMILY DERAEOCORINAE

The writer would state the essential characters of the subfamily Deraeocorinae to be as follows:

Arolia very slender, bristle-like, erect, either parallel or only slightly curved, usually inclined slightly forward away from the tarsus, sometimes apparently absent or difficult to distinguish from the hairs on the tarsus, in the latter case the claws distinctly cleft; claws usually cleft but if not then the bristle-like arolia are distinct; pseudoarolia absent.

In a key to the subfamilies the writer (1918) raised the group Deraeocoraria Van D. (not Douglas and Scott) to the rank of a subfamily. This seems to be necessary if we are to have a logical and workable classification of the subfamilies based on characters found in the arolia. For a comparison of the structure and form of the arolia for the different subfamilies of Miridae the reader is referred to a plate of drawings by the writer (1918). Mr. Van Duzee (1916) sought to credit his division Deraeocoraria to Douglas and Scott (1865) but it seems to the writer that such a procedure is scarcely permissible in view of the fact that all the species which were included in the Deraeocoridae of Douglas and Scott are now known to belong in genera outside the group in question.

Of the genera known to the writer the following are placed in the subfamily Deraeocorinae: *Deraeocoris* Kirschb., *Klopicoris* Van D., *Diplozona* Van D., *Eurychilopterella* Reut., *Cimatlan* Dist.; and

Deraeocapsus n. g. Other genera will doubtless be found to belong here when a careful study of the arolia is made throughout the family.

A diagnosis of the more essential characters of the genus Deraeocoris is as follows:

Body oval to suboval or more or less elongate, dorsum either glabrous or distinctly hairy, usually strongly shining, moderately or distinctly convex, distinctly punctate, head always and the scutellum in many species impunctate. *Head* usually broader than long, only rarely somewhat longer, very little depressed; basal carina usually distinct, in some species poorly defined or even absent, the vertex frequently indented just before the carina; collum frequently broadly exposed but exhibits transitions to forms where it is scarcely visible; front convex, smooth; tylus usually strongly protruding and well distinguished from the front; facial angle (when viewed from the side, the angle formed by the contour line of the tylus and the lower margin of the buccula) either a right angle or somewhat less; juga, lorae, and bucculae clearly defined, genae rather small, gula horizontal or only slightly depressed; eyes rather large and prominent, ovate when viewed from the side, nearly vertical or sloping slightly forward, the posterior margins usually nearly parallel with the base of the head but in a few forms slightly removed. *Rostrum* reaching upon the middle coxae, only very rarely attaining hind margins of the posterior coxae, but exceptionally long in *grandis* where it reaches the second ventral segment; first segment usually attaining the base of head, very rarely longer. *Antennae* inserted slightly above the lower margin of the eye, pubescent to distinctly hairy; segment I of variable length, in some forms extending beyond tip of tylus by two-thirds its length; segment II of variable thickness, usually distinctly thickened toward apex, in the males frequently nearly cylindrical and about the thickness of or thicker than segment I, while in the females distinctly slender on the basal half and gradually enlarged toward apex. *Pronotum* trapezoidal, collar formed by a narrow ring-like apical constriction extending over the sides and beneath; disk moderately convex, broader at the base than long, gently sloping at the sides and immarginate, or distinctly margined and provided with a slender carina, the numerous species exhibiting gradual transitions from the marginate to the immarginate, margins usually nearly straight, but may be either slightly sulcate or arcuate; calli apparent as smooth shining ovals, flat or convex, frequently confluent and distinctly convex, in a few species very finely punctured; disk rather coarsely punctate except between the calli (rarely two punctures between) and on the subelevated area just before. *Scutellum* either punctate or impunctate, strongly convex or nearly flat. *Hemelytra* surpassing the tip of the abdomen, frequently more elongate in the males; cuneus rather strongly deflected, the fracture deep; membrane biareolate, smaller areole frequently much reduced, the brachium usually broadly curved to form the larger areole; membrane variously infuscated, frequently affording specific characters. Xyphus flat or slightly convex, margins bordering the coxal cavities carinate. *Legs* moderately long, the hind femora elongate, moderately incrassate, pubescent or distinctly hairy; tibiae beset with prominent hairs, the hind pair frequently with a row of spines on the anterior face, the middle pair sometimes with two rows of spines, front pair with distinct spines only at the apex; tibial comb terminated dorsally by two parallel spines of equal size, and ventrally by two spines

the second of which is slightly removed at base and divergent apically (Pl. IX). Hind tarsus with first segment shorter to slightly longer than the second, sometimes slightly thicker than the second but never twice as thick. Claws distinctly cleft near base, or more slender and without a distinct notch; arolia very slender, bristle-like, erect and parallel or only slightly curved at tips, in the smaller species sometimes difficult to distinguish from the hairs on tarsus. Structure of the male genital claspers giving specific differences.

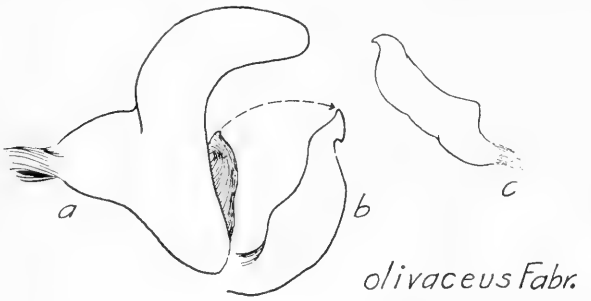

Fig. 1. *Deraeocoris olivaccus* Fabr., male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

METHODS OF STUDY

In this work exact measurements are given for structures of the insect which are commonly compared, one part with another, or measurements which in the writer's opinion are likely to be of value to future workers in the group. By following this plan it is feasible for a future student to make any comparison of structures he may so desire. Much has been said about the relative value of the various methods of comparing one structure with another where width and length are the factors involved, but it seems to the writer that the surest plan for meeting all the comparisons that the future student may require is to give all measurements in millimeters. This method need not preclude calling attention to the fact that the second antennal segment may be twice the length of the third, but when in addition, exact measurements are given for all the segments, the future student will also be in a position to compare the third or fourth segment with the first member, or with other parts as the need arises.

An explanation of the more important terms is as follows:

Length of the insect is the measurement taken between the tip of the tylus and the apex of the membrane; *width* is taken at the widest point on the hemelytra.

Head: *Width* is measured from the dorsal aspect and taken across the eyes at the widest point; *vertex* is the space between the inner margins of the eyes at the top of the head; *length* is measured laterally, taken at right angles to the base of the head, a point determined by the base of the gula and the hind margin of the eye.

Antenna: *Length* of the first segment is taken from the point of greatest constriction just above the basal knob, to the apex; the length of all the segments is taken when each is horizontal and extended straight to its full length.

Pronotum: *Length* is the greatest measurement that can be obtained along the median line, between the front margin of the collar and the hind margin of the disk, taken when the disk is turned as nearly horizontal as possible; *width* at base is taken across the basal angles of the disk; *width at anterior angles* is taken at the point where the front margins of the disk turn sharply inward to the constriction; *width of collar* is measured when viewed from the dorsal aspect.

The male genital claspers are shown in the present paper to be excellent characters for separating the species of Deraeocoris. For purposes of study and in order to make drawings of the genital claspers, the specimens should be placed in a moist chamber for a few hours. When sufficiently soft the tip of the abdomen may be picked off with the aid of two needles sharpened like chisels, working beneath the binocular microscope. The claspers may then be carefully separated from the attaching muscles and mounted for study. To make drawings the claspers should be removed to a dish coated with a mixture of paraffin and beeswax. This material makes an excellent surface for the manipulation of the claspers and for holding them in any desired position. The depth of the dish should be about one inch in order to guard against the claspers springing out when accidentally stressed by the point of the manipulating needle. Later the claspers may be removed on the point of a needle and attached with glue to a triangle mounted on the pin beneath the insect. At any future time the claspers may be studied as mounted on the pin, but if a change in position is required the claspers may easily be removed by placing the point in a watch glass containing water, and when the glue is dissolved remove to the paraffin dish as before.

The genital claspers figured in the present paper are all drawn to the same scale and turned to the same relative position for purposes of comparison. The figures were made by working with an eyepiece micrometer in the binocular microscope, a method by measurement which has proved more satisfactory than using the camera lucida.

The use of an eyepiece micrometer in the binocular microscope is a most valuable asset to the systematic worker, for by means of it a comparison between various parts of the insect may be made with the greatest speed and accuracy. For purposes of description the writer has found it a great saving of time to have worked out on a

card the equivalent in millimeters of all the micrometer readings from 1 to 100. Thus by a glance at the table one may read off in millimeters any micrometer measurement. Such a table is easily worked out by taking micrometer measurements on a standard millimeter rule which reads at least in tenths of a millimeter. Repeated measurements should be taken to ascertain the exact number of millimeters represented in say forty or fifty of the micrometer divisions, then by dividing one can find the length of a single micrometer division in thousandths of a millimeter. By a series of multiplications the table may be prepared and thus save future computations of this nature.

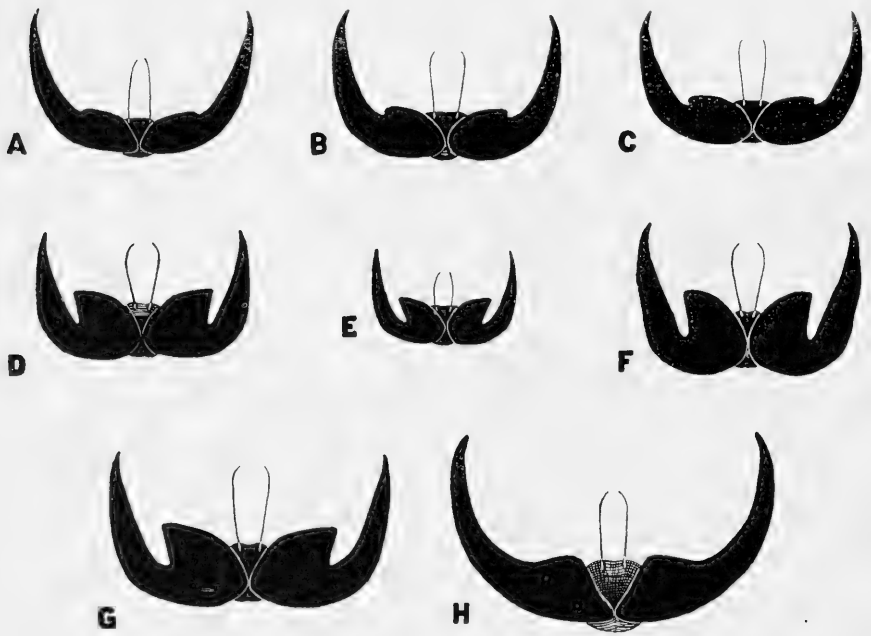

Fig. 2. Claws and arolia of representative species of Deraeocoris and Deraeocapsus. A, *Deraeocoris atriventris;* B, *D. pinicola;* C, *D. nigritulus;* D, *D. sayi;* E, *D. nebulosus;* F, *D. ruber;* G, *D. olivaceus;* H, *Deraeocapsus ingens.*

KEY TO THE GROUPS OF NORTH AMERICAN SPECIES OF DERAEOCORIS

1. Claws deeply cleft near base (fig. 2, D-G.) 1
   Claws not cleft or with only a slight indication (fig. 2, A-C) . . 7

2. Scutellum punctate 2
   Scutellum impunctate 5

3. Hind tibiae without distinct spines, clothed only with prominent black hairs . . (Exotic group containing genotype *olivaceus* Fabr.)
Hind tibiae with a row of distinct spines on the anterior face . . 4

4. Pronotum distinctly margined; eyes with hind margins practically in line with base of head, nearly in contact with collar; segment I of the antennae surpassing tip of tylus by less than half its length . . . . . Group I. (subgenus *Camptobrochis* Fieb.) p. 89
Pronotum immarginate; eyes sloping forward away from collar; segment I of antennae extending beyond tip of tylus by more than one-half its length . . . . . Group VII. p. 189

5. Dorsum practically glabrous, at most only sparsely and finely pubescent (not rubbed specimens), rarely a few hairs at anterior angles of pronotum; hind tibiae with a row of spines or heavily chitinized hairs on the anterior face 6
Dorsum heavily pubescent or hairy, at least with long hairs at anterior angles of pronotum; hind tibiae without distinct spines on the anterior face, usually rather closely set with prominent long hairs . . . . . Group VI. (subgenus *Euarmosus* Reut. p. 173

6. Form elongate (width not equal to one-half the length) Group III. p. 118
Form broad oval, strongly convex (width greater than or equal to at least one-half the length of the insect) . . Group IV. p. 145

7. Scutellum punctate . . . . . Group II. p. 111
Scutellum impunctate . . . . . Group V. p. 150

In an effort to construct keys which do not refer to the genitalia, and that may be used to determine both sexes, color characters have necessarily been introduced. A series of specimens have been available for study for most of the species which are likely to be confused and thus it is hoped that the limits of variation have been correctly estimated. The keys will at least serve for a close approximation of the species and for the person interested in accurate determinations the genitalia may be referred to for final confirmation. In the keys it was not always found convenient to have the species work out in order of their relationship but in the body of the text the species are arranged according to their natural sequence, in so far as this was possible to determine after due consideration of all available characters.

KEY TO THE SPECIES OF GROUP I (subgenus *Camptobrochis*)

The species of this group are all of small size, the dorsum is glabrous and shining, scutellum punctate, collum broadly exposed, vertex carinate, and several if not all the species pass the winter in hibernation as adults. The form of the left genital clasper is rather distinctive in that the internal arm tapers gradually to a point, therefore without a barb or hook at tip such as is found in all other groups of

Deraeocoris. There is a general similarity between the claspers of all the species and the differences are minute as compared with those found in the other groups of the genus. The right clasper is relatively small, yet careful comparison between the species has shown that slight but constant differences exist.

1. Dorsum bright red, clavus, a pair of large spots on corium and on pronotum black . . . . . *histrio* Reuter p. 100
   Dorsum not red and black as the above 2
2. Cuneus red or stained with reddish; membrane hyaline or with only a fuscous spot at apex, or a point each side of middle . . . 3
   Cuneus infuscated or with blackish, rarely reddish, but if so then the membrane distinctly blackish; membrane usually heavily marked with fuscous but if not then the cuneus without a trace of reddish . 5
3. Segment II of the antennae not equal to length of pronotum; two fuscous spots on apical half of membrane, darkest specimens developing a brownish cloud distad of the spots . . *ornatus* n. sp. p. 99
   Segment II of antennae equal at least to length of pronotum, or longer; membrane hyaline or with an oval-shaped fuscous spot at apex . . 4
4. Membrane infuscated at apex; cuneus red, calli and scutellum fuscous to black . . . . *cuneatus* n. n. (=||*cunealis* Reut.) p. 96
   Membrane hyaline; cuneus, calli and scutellum reddish . . . . . *tinctus* n. sp. p. 95
5. Membrane nearly clear but having two small fuscous points, one at each side on the apical half . . . . *nebulosus* Uhler p. 91
   Membrane either hyaline or with fuscous but not marked as the above 6
6. Membrane with apical half hyaline or nearly so, not distinctly marked with fuscous; dorsum uniformly black . . *bakeri* n. sp. p. 102
   Membrane with the apical half infuscated, if not distinctly so then the dorsum more or less pallid gray 7
7. Dorsum uniformly black, sometimes narrowly pale at base of embolium and corium; disk of pronotum never broadly pale or sordid gray at the sides . . . . . *brevis* Uhler p. 103
   Dorsum not uniformly black, more or less sordid or pallid gray and marked with fuscous or black 8
8. Frons black, palest forms with a pale spot on median line at vertex but never extending upon frons; juga always black; median line of disk pale or at least palely indicated; distinctly ovate, hemelytra of male short, similar to the female . . *nigrifrons* n. sp. p. 108
   Frons with median line pale, or at least palely indicated, rarely black but in such case the disk of pronotum black and only the lateral margins pale; juga may be black but in such case the median line of disk is also black; females ovate, hemelytra of males usually distinctly elongate 9
9. Juga black, or slightly brownish in pale forms; disk of pronotum with black color always confluent over the median line . . . . . *brevis piccatus* n. var. p. 105
   Juga pale, or at least brownish; pronotum grayish testaceous or with blackish, in the latter case the median line of the disk pale . . 10

10. Disk of pronotum fuscous to blackish behind the calli, the median line pale 11
Disk of pronotum grayish testaceous or brownish, never distinctly blackish behind the calli 12
11. Femora biannulate with pale on the apical half . . . . . *nubilus* n. sp. p. 106
Femora black, at most only obscurely marked with reddish brown on the apical half . . . . *nubilus obscuripes* n. var. p. 107
12. Membrane having only a transverse fumate cloud on the apical half which scarcely attains the margin; disk of pronotum brownish testaceous, the median line indicated by paler; posterior and intermediate femora pale on the basal half, but having two longitudinal series of fuscous spots on the anterior face . . . *validus* Reuter p. 108
Membrane heavily infuscated on the apical half; disk of pronotum grayish testaceous, the median line not indicated; femora uniformly lurid or brownish, distinctly pale only at the very apex . . . . . *luridipes* n. sp. p. 110

Deraeocoris (Camptobrochis) nebulosus Uhler

1872 *Camptobrochis nebulosus* Uhler, U. S. Geol. Serv. Terr., Montana, Prelim. rept., p. 417.
1876 *Camptobrochis nebulosus* Uhler, Bul. U. S. Geol. Serv., i, p. 319.
1878 *Camptobrochis nebulosus* Uhler, Proc. Bost. Soc. Nat. Hist., xix, p. 408.
1887 *Camptobrochis nebulosus* Provancher, Pet. Faune Ent. Can., iii, p. 116.
1894 *Camptobrochis nebulosus* Uhler, Proc. Calif. Acad. Sci., ser. 2, iv, p. 265.
1894 *Camptobrochis nebulosus* Van Duzee, Bul. Buf. Soc. Nat. Sci., v, p. 178.
1895 *Camptobrochis nebulosus* Uhler, *in* Gillette and Baker, Hemip. Colo., p. 38.
1909 *Camptobrochis nebulosus* Reuter, Acta Soc. Sci. Fenn. xxxvi, No. 2. p. 59.
1916 *Camptobrochis nebulosus* Van Duzee, Check List Hemip., p. 41.
1917 *Camptobrochys nebulosus* Van Duzee, Cat. Hemip., p. 354.

Small, ovate, shining; olivaceo-testaceous and darkened with blackish, or fuscous to blackish and marked with pale; membrane clear, a pair of small fuscous points on the apical half, one each side of the middle.

♂. Length 3.5 mm. *Head*: width .97 mm., vertex .34 mm., length .4 mm.; impunctate shining, carina prominent, sharply delimited behind but anteriorly sloping gently to an impression on vertex; collum black, shining, broadly exposed between carina and collar, a normal condition in this and related species; black, carina broadly, juga and connecting line along base of tylus with vitta on median line of frons, mark on tylus, bordering inner margin of eyes and terminating in a spur on front margin of vertex, pale to olivaceo-testaceous. *Rostrum*, length 1.22 mm., attaining middle of intermediate coxae, piceous, slightly paler at the joints.

Antennae: segment I, length .25 mm., black, very finely pale pubescent; II, 1.17 mm., exceeding length of the pronotum, cylindrical, rather thick (.07 mm.), constricted suddenly at base and apex, yellowish to brownish, apical one-fourth and the base darkened, frequently the entire segment blackish, clothed with fine short pale pubescence; III, .34 mm., slender, fuscous; IV, .34 mm., similar to III only slightly more slender.

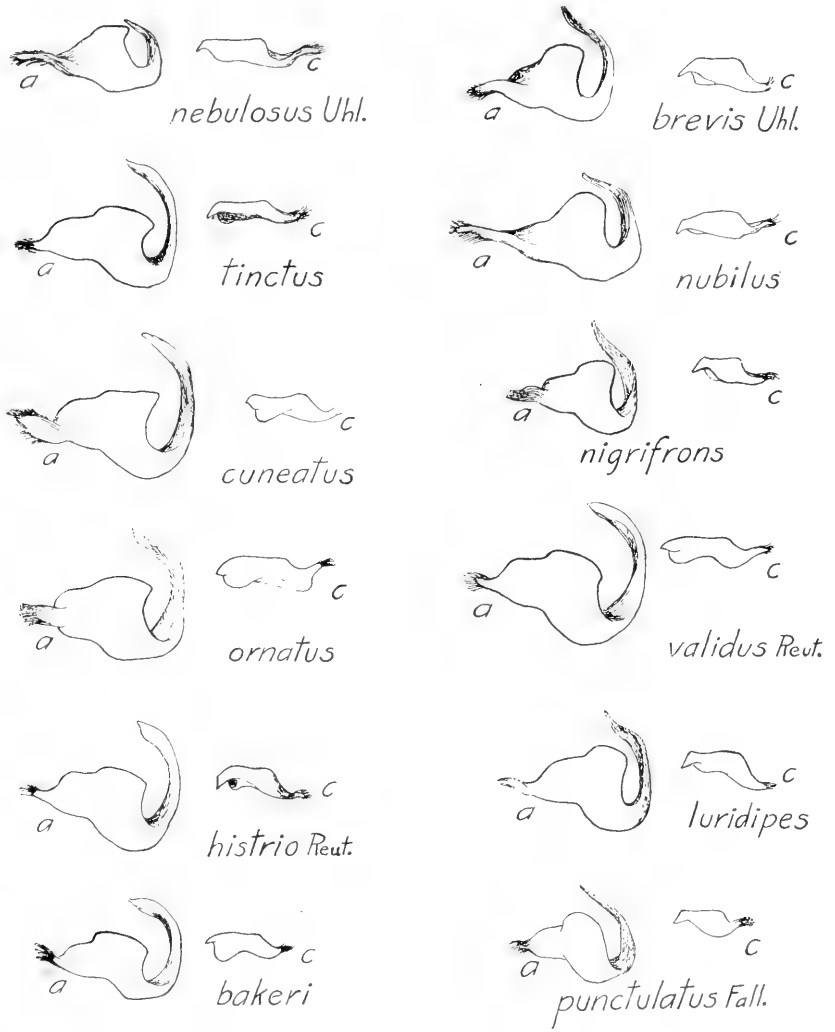

Plate X. Male genital claspers of the species of subgenus Camptobrochis; a, left clasper, lateral aspect; c, right clasper, lateral aspect.

Pronotum: length .91 mm., width at base 1.51 mm., anterior angles .71 mm., collar .54 mm.; disk moderately convex, lateral margins very slenderly carinate, slightly sulcate at middle, anterior angles distinct, posterior margin sinuate; calli flat, very slightly impressed and delimited behind by coarse punctures, black, seven to nine very fine punctures on the disk of each; collar slightly arcuate to the rear, yellowish; disk and pleural area coarsely but not densely punctate; disk olivaceo-testaceous, punctures always, a cloud of varying size each side of the median line and frequently upon the basal angles, fuscous to black; in darkest specimens only the slender basal margin, irregularly along median line, more or less between punctures posterior to outer margins of calli, testaceous; propleura black, lower margins pale, xyphus black, distinctly convex. *Scutellum* coarsely punctate, nearly flat, black, apex and lateral margins at base ivory-white; mesoscutum slightly exposed, black. *Sternum* and pleura black, ostiolar peritreme and usually the posterior and ventral margins of the epimera white.

Hemelytra: greatest width 1.74 mm., moderately convex, glabrous, shining, coarsely but not densely punctate, punctures black; testaceous, translucent, blackish color appearing first at apex of embolium and corium, then transversely across middle of corium and at base, and more or less broadly each side of the claval commissure; darkest specimens may be black except on base of embolium and clavus and a spot near base of corium. *Cuneus* nearly triangular, strongly deflexed, translucent on basal half, punctures and the apical half black. *Membrane* clear, the veins infuscated, more strongly posteriorly and invading the membrane slightly; two small fuscous points on the apical half, one each side of the middle, these spots being distinctive of the species.

Legs: coxae and femora black; femora shining, the apices yellowish brown, sometimes with an indistinct annulus just before, finely pale pubescent, a few fine long hairs on the antero-ventral surface; tibiae yellowish, slightly at knee, narrowly just below, more broadly at near middle, fuscous to blackish, the apices very slightly darkened; tibiae clothed with fine rather short pale pubescence, the anterior surface of middle and hind pair armed with a row of brownish spines, in length equal to thickness of the segment; tarsi testaceous, apical segment becoming blackish; claws deeply cleft, piceous; arolia minute, more slender than any hairs on tarsus, erect and subparallel, converging slightly apically (Fig. 2, E).

Venter: black, shining, finely pale pubescent; genital claspers distinctive of the species (Pl. X).

♀. Length 3.9 mm., width 1.94 mm., very similar to the male but slightly larger and more robust. Segment II, length .94 mm., slender on basal half, enlarged toward apex, the greatest thickness not equal to more than the diameter of segment I; yellowish to brownish, the apical one-fifth and less broadly at base, piceous, very finely pale pubescent.

Plesiotypes: ♂♀ July 18, Springfield, Missouri (H. H. Knight); author's collection. *Specimens examined*: ALABAMA,—♀ June 9, Auburn (H. H. Knight), tenerel condition. ARIZONA,—6♂♀ July 8—Aug. 6, Huachuca Mts., (H. G. Barber). COLORADO,—♂♀ July 28, Grand Junction. CONNECTICUT,—♀ Mar. 18, ♀ Aug. 6, New

Haven. ♀ Feb. 21, South Meriden (H. Johnson). ♀ Oct. 2, Westville. DISTRICT OF COLUMBIA,—May 9 to Oct. 20 (U. S. N. M.). ♂♀ Aug. 4, 1888 (Pergande). ♂ June 23, ♀ July 1, 3♂ 1♀ July 15, ♂ Aug. 18, ♀ Nov. 8, Washington (W. L. McAtee). FLORIDA, —♂ 2♀ Nov. 5-24, Monticello (H. B. Scammell). GEORGIA,— ♀ Sept., 1878 (C. V. Riley). ♂ July 31, Thomasville (C. S. Spooner). ♂ Aug. 6, Atlanta (J. C. Bradley). ILLINOIS,—♂♀ June 26 to Sept. 8, Urbana; ♂ June 13, Cobden; ♂ June 29, White Heath; ♀ July 6, Elizabeth; 3♂ ♀ Aug. 9, Du Bois; ♂♀ Aug. 18, Metropolis; ♀ Aug. 22, Meredosia (Ill. Nat. Hist. Survey). ♂ July 14, Chicago; ♂♀ Aug. 27, Gary; ♀ Sept. 18, Palos Park; ♀ July 16, Willow Springs (W. J. Gerhard). LOUISIANA,—♀ Sept. 15, Natchitoches. MARYLAND,— ♂♀ July 5, Great Falls, (O. Heidemann). ♂ July 26, Plummers Is. (W. L. McAtee). ♀ Aug. 6, Plummers Is. (R. C. Shannon). ♀ Aug. 5, Hagerstown. ♂ Sept. 25, Baltimore (P. R. Uhler). ♂ Feb. 9. Riverdale (W. W. Wallis). MASSACHUSETTS,—♂♀ Mar. 26 to Sept. 7, Northampton; ♂ May 14, Wellesley; ♀ 13 Aug., ♂♀ Sept. 2, Lynn; ♀ Sept. 7, Saugus; ♀ Sept. 24, ♀ Oct. 13, Boston (H. M. Parshley). 2♂ July 20, Sharon (E. P. Van Duzee). ♀ July 22, Auburndale; ♂♀ Sept. 3, Needham, (C. W. Johnson). MINNESOTA,—♂♀ July 8 to Oct. 9, St. Anthony Park (H. H. Knight), breeding on *Quercus macrocarpa*. MISSOURI,—♂♀, nymphs, July (C. V. Riley). ♂♀ May 30 to July 28, Charleston (E. H. Gibson). 12♂♀ July 18, Springfield; 12♂♀ July 22, Hollister (H. H. Knight), on young white oak. NEBRASKA,—♂ Aug. 10, Falls City (H. G. Barber). NORTH CAROLINA,—♂♀ April 4 to June 9, Southern Pines (A. H. Manee). ♂♀ June 1 to July 14, Black Mts. (Beutenmuller). ♂ Oct. Raleigh (J. E. Eckert). NEW HAMPSHIRE,—♂♀ Franconia; ♂♀ Mt. Washington (Mrs. A. T. Slosson). NEW JERSEY,—♂♀ July 27, Bear Swamp, Ramapo Mts. (H. G. Barber). ♀ Sept. 7, Fort Lee. NEW YORK, —♂♀ June 8 to Sept. 27, Batavia; ♂ July 27, McLean; ♂♀ Feb. 13 (under bark of log), 2♀ April 8 (under sycamore bark), 2♂ 4♀ July 26, ♂ Oct. 19 (in house), Ithaca (H. H. Knight). ♂♀ June 30 to July 27, White Plains (Torre-Bueno). ♀ July 24, Salamanca; ♀ June 13, Niagara Falls (E. P. Van Duzee). ♀ July 19, Cranberry Lake (H. Osborn). ♀ Aug. 27, Schenectady, (O. Heidemann). ♂ Aug. 1, Maspeth; ♀ Aug. 24, Rockaway Beach; ♀ Sept., Port Washington; 2♂ July 23, Staten Is. (C. E. Olson). ♀ July 9, Staten Is.; ♀ Sept., Yaphank; ♂ Oct. 9, Brooklyn; ♀ May 26, Rockaway Beach (Wm. T. Davis). ♂♀ July 30, Cold Spring Harbor, ♀ Aug. 3, West Point (H. G. Barber). OHIO,—♀ Sept. 2, Vermillion (E. P. Van Duzee).

PENNSYLVANIA,—♀ May 25, Philadelphia. ♂♀ Nov. 23, Harrisburg. ♂♀ Delaware Watergap (Mrs. A. T. Slosson). ♂ July 22, Reading (W. J. Gerhard). TEXAS,—♀, September. VIRGINIA,—♀ June 19, 1881 (P. R. Uhler). ♀ July 28, Fairfax Co. (R. C. Shannon). ♂ Aug. 23, Vienna (H. G. Barber). 2♂ ♀ Aug. 28, Pulaski (Torre-Bueno). ONTARIO, CANADA,—2♀, Grimsby (Petit). ♂♀ June 22, Norway Point, Lake of Bays (J. McDunnough). ♀ Aug. 18, Ottawa (G. Beaulieu).

This species has been frequently taken in hibernation, under bark and in buildings. In Missouri the writer found it numerous on young white oak and more recently, in Minnesota, the nymphs and adults were found abundant the latter part of July on *Quercus macrocarpa*. The majority of the nymphs mature the latter part of July and the adults are most abundant on the trees in early August. On October 6 and again October 9 a living specimen of *nebulosus* appeared on the writer's table in the laboratory while he was working up data on this very form. The specimens came no doubt from the bur oaks on the campus where the species bred abundantly, later entering the building for hibernation. The species has been taken singly on various plants; also it is frequently attracted to lights.

Specimens taken August 4, 1888, by Pergande are labeled "on oak." Specimens from Miss Murfeldt and now in the U. S. N. M. collection, bear the label: "Predatory bug, on *Ph. Rileyi,* Sept. 2, 1889." This evidently refers to *Phylloxera rileyi* Riley of the oak, the same tree upon which *nebulosus* is most frequently found.

The type locality for this species is not given in the original description, but the specimens probably came from Colorado as was the case with several other species described in the same paper. The type specimens are not to be found, or at least were not recognized, in the material of the National Museum collection.

Deraeocoris (Camptobrochis) tinctus new species

Slightly larger than *nebulosus,* structurally and in general aspect rather intermediate between *cuneatus* and *nebulosus;* testaceous or pale brownish, stained with reddish, punctures black, hemelytra somewhat translucent, membrane clear or only slightly brownish bordering the brachium; structurally as in *nebulosus* unless otherwise noted.

♂. Length 4 mm. *Head*: width .97 mm., vertex .41 mm., length .43 mm.; pale to brownish, the areas represented by black in *nebulosus* are replaced chiefly by brown in this species; collum pitchy black, spot each side of vertex, sides of tylus, genae, juga and bucculae, more or less blackish. *Rostrum*, length 1.37 mm., attaining middle of intermediate coxae, blackish, paler at the joints.

Antennae: segment I, length .3 mm., brownish to blackish, becoming darker first at base and apex; II, 1.05 mm., equal to length of pronotum, greatest thickness .08 mm., brownish black, usually paler on the middle one-third; segments III and IV missing.

Pronotum: length 1.05 mm., width at base 1.71 mm., anterior angles .8 mm., collar .63 mm.; more finely and sparsely punctured than in *nebulosus;* disk rather uniformly testaceous or pale brownish, calli reddish brown, sometimes becoming blackish around the margins, disk of each callus with two or three very fine punctures; propleura testaceous, paler below, surrounding base of coxal cleft and the stricture above black, collar pale; xyphus slightly convex, blackish, rather longly pale pubescent. *Scutellum* punctate, reddish brown, punctures black, lateral margins and apex white, median line pale, frequently indistinct; frenal margin and the suture separating the mesoscutum black; mesoscutum scarcely exposed, brownish, sutures black. *Sternum* and pleura brownish black, basalar plate, posterior and ventral margins of epimera, more or less pale; ostiolar peritreme white.

Hemelytra: width 1.91 mm., glabrous, pale yellowish, translucent, slightly reddish at apex of embolium; punctures moderately fine, uniformly distributed, black. *Cuneus* reddish translucent, outer margin paler, punctures very fine or absent. *Membrane* clear, brachium brownish at apical margin of cells, frequently the membrane slightly stained at apex of larger areole.

Legs: coxae fuscous to black, paler at apices; trochanters and femora testaceous to reddish brown, translucent, apical half usually more reddish, apex pale, frequently a subapical band is also apparent, presenting a reddish annulus dividing the pale; tibiae pale, banded as in *nebulosus* except that the black is replaced by reddish brown, the knees becoming piceous and the apical band fuscous; tarsi fusco-brownish, becoming blackish on the apical segment.

Venter: reddish to fusco-brownish and piceous, finely pale pubescent; genital claspers (Pl. X) distinctive of the species.

♀. Length 4.4 mm., width 2.1 mm.; very similar to the male but slightly larger; segment II, length 1.05 mm., slender, slightly thickened toward apex, piceous to black, the middle one-third pale to reddish brown.

Holotype: ♂ July 28, Grand Junction, Colorado; Cornell University collection. *Allotype*: same data as the type. *Paratypes*: 5♂ 4♀, topotypic. ♀ May 27, Delta, Colorado.

Deraeocoris (Camptobrochis) cuneatus new name

1909 *Camptobrochis validus* var. *cuncalis* Reuter, Acta Soc. Sci. Fenn., xxxvi, No. 2, p. 59. (name preoccupied)
1916 *Camptobrochis validus* var. *cuncalis* Van Duzee, Check List Hemip. p. 41.
1917 *Camptobrochys validus* var. *cuncalis* Van Duzee, Cat. Hemip., p. 354.
1919 *Camptobrochis poecilus* (Reuter MS) McAtee, Ent. News xxx, p. 246.

Slightly larger than but structurally very close to *nebulosus;* olivaceo-testaceous to brownish and blackish, cuneus red, membrane clear, a rather distinct somewhat oval-shaped fuscous spot on the apex.

♂. Length 4.2 mm. *Head*: width .92 mm., vertex .37 mm., length .43 mm.; structurally and in color markings very similar to *nebulosus*, the pale color

more broadly developed, bases of genae and lorae, narrow tip of tylus and lower margin of bucculae, yellowish, eyes brown to blackish; genae longly pale pubescent. *Rostrum,* length 1.48 mm., just reaching upon the intermediate coxae, brownish to piceous, paler at the joints.

Antennae: segment I, length .37 mm., black, shining, slightly pale at extreme tip; II, 1.2 mm., cylindrical as in *nebulosus* (.08 mm. thick), black, pale pubescent; III, .43 mm.; IV, .48 mm.; the last two segments black, pale pubescent, a few hairs equal to twice the thickness of segment.

Pronotum: length 1.08 mm., width at base 1.8 mm., anterior angles .83 mm.; nearly as in *nebulosus,* lateral carina and anterior angles more distinct, anterior margin distinctly sulcate at termination of anterior angles; calli very slightly convex, black, five to seven punctures on disk of each; disk more or less brownish, narrow basal margin, lateral carina, median line, just before calli, more or less just posterior to outer angles of calli, pale to testaceous; propleura brownish black, lower margin, anterior margin of xyphus and the collar, pale to yellowish. *Scutellum* punctate, brownish black, apex and lateral margins basally ivory-white, the median line palely indicated. *Sternum* and pleura black, basalar plate, posterior and ventral margins of epimera brownish; ostiolar peritreme white.

Hemelytra: width 2 mm., translucent yellowish brown, punctures black; becoming dark brownish or piceous on disk of corium, tip of embolium, rather broadly along claval commissure and narrow margin bordering scutellum. *Cuneus* bright red, sometimes brownish at apex and narrowly testaceous at base. *Membrane* pale, veins infuscated, infuscation invading the membrane slightly at posterior margin of areoles; distal one-third occupied by a rather distinct oval-shaped pale fuscous spot, the infuscation usually not attaining the margin.

Legs: reddish brown to piceous or black, trochanters and apices of coxae testaceous; apices of femora pale, usually with an indistinct annulus just before apex; tibiae pale or yellowish, knees, narrow band just below and sometimes connected dorsally with spot on knee, a broader band just short of middle, band at apex altho in paler specimens nearly obsolete, dark brownish to piceous, bands on anterior tibiae less distinct; tarsi testaceous, becoming blackish at apex; pubescence, spines, and claws similar to *nebulosus;* in the reddish or pale specimens the piceous coloration may appear in spots on anterior face of femora.

Venter: dark reddish to piceous or black, shining, finely pale pubescent; genital claspers (Pl. X) distinctive of the species.

♀. Length 4.9 mm., width 2.4 mm.; very similar to the male but slightly more robust; segment II, length 1.2 mm., just equal to length of the pronotum, slender as in the female of *nebulosus,* slightly enlarged toward apex, piceous, the middle one-third yellowish or brownish.

Plesiotypes: ♂ May 21, Orange, Conn. (A. B. Champlain); ♀ June 6, Brown's Ferry, Savannah river, South Carolina (H. H. Knight); author's collection. *Specimens examined*: CONNECTICUT,—♀ May 15, Portland (B. H. Walden), on *Pinus strobus.* ♀ May 15, New Haven (A. B. Champlain). DISTRICT OF COLUMBIA, —♂ April 21, ♀ July 10, 1885; ♀ June 20, 1888, ♀ June 20, 1893, ♀ July 20, Washington (O. Heidemann). ♀ May 20, (D. C. Clemons).

ILLINOIS,—2♂, ♀ Aug., 1889, Quincy (C. A. Hart). ♀ June 14, Carmi. ♀ June 24, Grand Tower. MARYLAND,—♀ Feb. 1, Little Falls, under sycamore bark; ♂♀ Mar. 1, East Riverdale (W. L. McAtee), under birch bark. ♂ Aug. 22, Blandensburg; ♂ Aug. 29, Forest Glen (H. G. Barber). ♂ July 8, 1893, Glen Echo; ♀ Aug. 10, 1890, Blandensburg (O. Heidemann). MASSACHUSETTS,—♀ April 6, Forest Hills (C. L. Mason). ♀ Aug. 8, Chester (C. W. Johnson). NEW JERSEY,—♂♀ Oct. 3, Roselle Park; ♀ Oct. 15, Madison (H. G. Barber). NORTH CAROLINA,—♂♀ July 15, Swannanoa, alt. 3,000 ft. (R. W. Leiby). NEW HAMPSHIRE,—♂♀ Mt. Washington (Mrs. A. T. Slosson). NEW YORK,—♀ July 24, on *Pinus strobus*, ♀ July 26, Ithaca; ♀ July 27, McLean (H. H. Knight). PENNSYLVANIA,—♂ 3♀ Delaware Watergap (Mrs. A. T. Slosson). SOUTH CAROLINA,—♀ June 6, Brown's Ferry, Savannah River (H. H. Knight), taken on *Alnus rugosa*. WEST VIRGINIA,—♀ July 25, 1887, Berkeley Springs (O. Heidemann).

This species was described by Reuter as a variety of *validus* but it proves on close examination to be a distinct species. It may be distinguished by the well defined and punctate calli, the rich brownish color with red cuneus, more or less oval-shaped fuscous spot at apex of membrane, and by the structure of the genital claspers (Pl. X). *Cuneatus* is more robust than *nubilus*, particularly the males, which have shorter hemelytra in proportion to the body, being more like the females in form.

Mr. McAtee found this species developing on *Alnus rugosa* which is probably the preferred host plant. In New York the writer took a teneral specimen on *Pinus strobus* which had undoubtedly developed on that tree, and the species has also been collected on the same tree in Connecticut. Judging by the habits of related species, the writer would not be surprised to learn that *cuneatus* is predaceous upon the alder blight aphid, *Pemphigus tesselatus* Fitch, and the pine bark aphid, *Chermes pinicorticis* Fitch.

Reuter's chirotype for the manuscript name *"Camptobrochis poecilus"* is in the U. S. National Museum collection,—♂ Washington, D. C. (O. Heidemann). Uhler's manuscript name for the species was *"Camptobrochis crassicornis,"* three specimens having been noted with this label.

Deraeocoris (Camptobrochis) ornatus new species

Very similar to *cuneatus*, but segment II of the antennae is shorter in proportion to length of pronotum, also the punctures on the disk are finer; two rounded fuscous spots on apical half of membrane are suggestive of *nebulosus* but darkest specimens may develop a brownish cloud distad of the spots.

♂. Length 4.5 mm. *Head*: width 1.01 mm., vertex .4 mm., length .48 mm.; nearly as in *cuneatus*, the front less convex, reddish brown each side of median line; lorae, genae, bucculae, apical margin of tylus, and two impressed spots on vertex, black. *Rostrum*, length 1.48 mm., nearly as in *cuneatus*.

Antennae: segment I, length .34 mm., basal half reddish brown, piceous apically; II, 1.11 mm., scarcely equal to length of pronotum, thickness .085 mm., black, brown annulus indicated at middle; III, .4 mm.; IV, .4 mm.; last two segments black, pale pubescent as in *cuneatus*.

Pronotum: length 1.14 mm., width at base 1.92 mm., anterior angles .92 mm., collar .67 mm.; more finely punctate and the lateral margins of the disk more nearly straight than in *cuneatus;* calli black, reddish brown around the margin and extending more or less toward the anterior angles of disk; grayish testaceous, paler near margins of disk and at the median line, not so distinctly brownish as in *cuneatus*. *Scutellum* reddish brown or becoming piceous, punctures black, apex and lateral margins ivory-white, median line usually indicated; mesoscutum black, scarcely exposed. *Sternum* and pleura black, posterior and ventral margins of epimera brownish; ostiolar peritreme white.

Hemelytra: width 2.08 mm.; grayish translucent, punctures, frenal margin, more or less along commissure, spot at middle and along apical margin of corium, piceous, tip of embolium reddish translucent. *Cuneus* red, translucent, paler at inner angle and outer margin, slenderly piceous on inner margin near apex, several very fine black punctures evident. *Membrane* pale, brachium infuscated, more or less invading the membrane on both sides; a pair of rounded fuscous spots on the apical half, one each side of the middle, darkest specimens developing a brownish cloud distad of the spots.

Legs: coxae black, the apices and trochanters testaceous; femora reddish brown, piceous on the basal half, in darkest specimens only the apical one-third paler and annulated with reddish; tibiae nearly as in *cuneatus*, annulations dark reddish or piceous; tarsi brownish black, the two basal segments paler.

Venter: dark reddish to piceous and black, shining, pale yellowish pubescent; genital claspers (Pl. X) distinctive of the species.

♀. Length 4.8 mm., width 2.34 mm., very similar to the male; segment II, length 1.08 mm., slightly shorter than length of pronotum (1.2 mm.), black, the middle one-third testaceous or brownish, all the other segments black, pubescence as in *cuneatus*.

Holotype: ♂ Oct. 22, Yankton, South Dakota; author's collection. *Allotype*: topotypic. *Paratypes*: ILLINOIS,—♀, "Ill." (C. V. Riley). MISSOURI,—♂ July 12, Wittenburg. ♂♀ "Mo." (C. V. Riley). NEBRASKA,—♀ Aug. 28, Bigelow (H. G. Barber). SOUTH DAKOTA,—3♀, taken with the types.

Deraeocoris (Camptobrochis) histrio (Reuter)

1876 *Callicapsus histrio* Reuter, Ofv. Kongl. Sv. Vet.-Akad. Forh., xxxii, No. 9, p. 75.
1895 *Callicapsus histrio* Blatchley, Psyche, vii, p. 279.
1909 *Camptobrochis histrio* Reuter, Acta Soc. Sci. Fenn. xxxvi, No. 2, pp. 54, 58.
1917 *Camptobrochys (Callicapsus) histrio* Van Duzee, Cat. Hemip., p. 355.

♂. Length 4.6 mm. *Head*: width .91 mm., vertex .42 mm., length .48 mm.; carina present but low and broad, slightly impressed just before, collum broadly exposed as in other species of this group; black, carina, spot each side of vertex bordering the eye, slender ventral margin of bucculae and tylus, pale. *Rostrum*, length 1.85 mm., reaching to middle of hind coxae, piceous, somewhat paler on segment I.

Antennae: segment I, length .42 mm.; II, 1.2 mm., nearly cylindrical but slightly more slender toward the base, equal in thickness to segment I, pubescence pale to black, rather short and closely set, longest hairs not equal to thickness of the segment; III, .45 mm.; IV, .51 mm.; black, the last two segments slender, very finely pale pubescent, a few exserted hairs equal to thickness of the segment.

Pronotum: length 1.11 mm., width at base 1.85 mm., anterior angles .83 mm., collar .65 mm.; disk convex, lateral margins distinct, nearly straight, strongly narrowed anteriorly, coarsely and rather uniformly but not densely punctate; disk pale red to bright red, punctures becoming black, calli except at antero-lateral angles and a widening stripe behind each which falls short of the basal margin, black; calli moderately convex, three or four fine punctures on the disk of each, delimited behind by coarse punctures, a pair of deep punctures set between the callosities, one each side of the median line; propleura black, red dorsally, pale bordering the coxal cavities; xyphus moderately convex, black, paler at margins and including the collar in front, pale pubescent. *Scutellum* red, a black spot on median line at base, punctate, the punctures only slightly darkened. *Sternum* and pleura black; ostiolar peritreme black but usually with some pale points.

Hemelytra: width 2.2 mm., red (sometimes slightly pallid where the melanin pigment has not been fully oxidized to red), clavus except apex, triangle at base of corium, and a large somewhat rounded spot on the apical half black, punctures mostly blackish. *Cuneus* red, punctures concolorous, usually a blackish streak along inner margin near apex. *Membrane* dark fuscous, an irregular transverse band at middle pale, the apical half with a crescent-shaped fuscous cloud which does not always attain the margin.

Legs: black, shining; tibiae biannulate with pale, the front pair frequently with only one annulus; tarsi brownish black, darker at apex, claws brownish to piceous.

Venter: black, shining, finely pale pubescent; genital claspers (Pl. X) distinctive of the species.

♀. Length 5 mm., width 2.2 mm.; very similar to the male but usually slightly larger; segment II of antennae more slender on the basal half, tapering from base to larger at apex.

Plesiotypes: ♂♀ August 17, Langdon, Missouri (H. G. Barber); author's collection. *Specimens examined*: CALIFORNIA,—♂♀ Aug. 1, Lakeport, Lake Co. (E. P. Van Duzee); one specimen Marysville, Yuba County (*fide* Van Duzee). DISTRICT OF COLUMBIA,—♀ Nov. 24, 1886, ♀ Feb. 21, 1887 (T. Pergande). ♂ Nov. 4, 1887 (O. Heidemann). ILLINOIS,—♂♀ July 4 to July 31, 3♂ 1♀ Aug. 18, ♂ Aug. 23, ♂ Nov. 1, Chicago; ♀ Aug. 31, Argo; 2♂ Sept. 19, Palos Park (W. J. Gerhard). ♀ June 1, Grand Tower; ♂ June 14, Savanna (J. R. Malloch). ♂ June 8, 1890, ♂ June 17, 1887, "Ill." (C. A. Hart). INDIANA,—♂♀ July 14, Mineral Springs (A. B. Walcott). IOWA, —♂♀ "Ia." (U. S. N. M.). KANSAS,—♂ Onaga (Crevecoeur). ♀ June 19, ♂ July 13 (Popenoe); 2♂ Sept. 1, (J. B. Norton); ♂ Mar. 16, ♂ July 11, ♂ Sept. 23 (P. J. Parrott); ♀ June, Riley County (Marlatt). 2♂ June 28, Wellington. MICHIGAN,—♂ 2♀ July 3, Berrien County (R. F. Hussey). MINNESOTA,—♀, "Minn." (Lugger collection). MISSOURI,—♂ July 6, ♀ July 10, 2♂ 2♀ July 14, Langdon (H. G. Barber). 2♂ July 22, O'Fallon (W. L. McAtee). MONTANA,—♀ Aug. 21, 1892, Assinuaboin (Heidemann collection). NEBRASKA,—♀, "Neb." (Lugger collection). NEW YORK,—♂ Aug. 21, Ithaca. ♀ Aug. 30, Cold Spring Harbor, Long Island (H. M. Parshley). SOUTH DAKOTA,—2♀ Aug. 5, 2♂ Sept. 25, Ardmore (E. G. Holt).

This species has frequently been taken in hiberation as is shown by the above records. Mr. W. J. Gerhard found the species fairly abundant about electric lights in the suburbs of Chicago during July and August, 1914. Probably the majority of all specimens collected have been taken at lights or in hibernation. Nothing is known regarding the life history altho the general scarcity of specimens and the wide distribution of the species suggests that it is predaceous in habits. Blatchley (1895) records two specimens that "were found beneath the bark of a black oak log (*Quercus coccinea tinctoria* Gray) which lay on the side of a high sandy hill near the Wabash River. Feb. 19, 1893."

Reuter (1876) described *histrio* and erected the genus Callicapsus for its reception, recording the locality as "Texas" and "Carolina." The type specimens are probably still to be found in the Stockholm National Museum. In a later examination of the species, Reuter (1909) placed it in Camptobrochis, pointing out that structurally *histrio* differs very little from *punctulatus* Fallen and other closely related species.

Deraeocoris (Camptobrochis) bakeri new species

1909 †*Camptobrochis brevis* Reuter, Acta Soc. Sci. Fenn., xxxvi. No. 2, p. 59.

Black, shining, legs reddish brown; scarcely larger than *nebulosus*, anterior angles of pronotum broader and more prominent; apical half of membrane clear.

♂. Length 4.1 mm. *Head*: width .91 mm., vertex .45 mm., length .43 mm.; black, polished, carina ivory-white, apical half of tylus more or less and sometimes the median line of front pale or brownish; collum broadly exposed, front more convex than in *nebulosus*. *Rostrum*, length 1.35 mm., reaching upon middle of intermediate coxae, piceous, the two basal segments more brownish.

Antennae: segment I, length .31 mm.; II, .94 mm., nearly cylindrical, thickness .06 mm., slightly thicker on the apical half; III, .37 mm.; IV, .34 mm.; black, pale pubescent, the longer hairs slightly darkened.

Pronotum: length 1.03 mm., width at base 1.65 mm., anterior angles .86 mm., collar .6 mm.; black, disk broader and the anterior angles more prominent than in *nebulosus*, coarsely and closely punctate; calli confluent, forming a transverse convex polished area, usually with two or three fine punctures near the posterior lateral angles; collar white except just behind the eyes, as viewed from above distinctly arcuate to the rear; basal margin of disk very slenderly, lower pleural margins and xyphus except on disk, pale to white. *Scutellum* black, coarsely punctate, narrow apex and sometimes the lateral margins very slenderly pale. *Sternum* and pleura black, posterior and ventral margins of epimera pale; ostiolar peritreme white.

Hemelytra: width 1.72 mm.; black, closely punctate, more coarsely on clavus near scutellum; glabrous or only minutely and sparsely pubescent on embolium. *Cuneus* black, distinctly punctured. *Membrane* clear, veins and apical half of areoles infuscated, the infuscation invading the membrane narrowly just posterior to the brachium.

Legs: testaceous to reddish brown, coxae fuscous to black; basal half of femora frequently piceous, the apical half not distinctly banded; tibiae reddish brown, usually banded with darker at middle and apex, the knee and a line just below on dorsal side reddish to piceous; tarsi infuscated, becoming black toward apex, claws piceous.

Venter: dark reddish brown to piceous and black, shining, pale pubescent; genital claspers (Pl. X) distinctive of the species.

♀. Length 4.3 mm., width 2.08 mm., very similar to the male but more robust; segment II, length 1 mm., slender, gradually thickened toward apex (.057 mm. thick); all the segments black, pale pubescent, beset with several long pale or slightly darkened hairs.

Holotype: ♀ July, Ormsby County, Nevada (C. F. Baker); author's collection. *Allotype*: topotypic; Cornell University collection. *Paratypes*: NEVADA,—2♂ July 6, Ormsby County (C. F. Baker). ♀ Virginia City; ♀ "76." (Uhler collection). CALIFORNIA,—♂ Aug. 24, Donner Lake, Placer Co. (W. M. Giffard). ♀ July 10, Lake Tahoe. UTAH,—♂ Sept. 18, Milford (J. C. Bradley). COLORADO,—♂♀ July 25, Rifle; ♀ May 27, Delta.

Uhler did not separate this species from his *brevis* as is shown by determination labels on specimens. Reuter (1909) had this species before him when discussing *brevis,* a fact easily ascertained from that author's remarks as well as a determined specimen in the Heidemann collection. Uhler's description of *brevis* was misleading in that he described the membrane as "soiled white," a term more applicable to the species here described.

Deraeocoris (Camptobrochis) brevis (Uhler)

1904 *Camptobrochis brevis* Uhler, Proc. U. S. Natl. Mus., xxvii, p. 359.
1917 *Camptobrochys brevis* Van Duzee, Cat. Hemip., p. 354.

Piceous to black, shining, larger and more elongate than *nebulosus;* membrane infuscated near the apex.

♂. Length 4.7 mm. *Head*: width .97 mm., vertex .4 mm., length .48 mm.; black, shining, the carina, spot near front margin of eye and a more obscure mark on median line of frons, yellowish to ivory-white, eyes brownish to black. *Rostrum,* length 1.54 mm., attaining the middle of the intermediate coxae, piceous, sometimes slightly paler at apex of first and second segments.

Antennae: segment I, length .34 mm.; II, 1.2 mm., thickness of apical half (.08 mm.) very little greater than on basal half (.07 mm.); III, .45 mm.; IV, .38 mm.; black, very finely pale pubescent, segment II, with a few hairs equal to thickness of the segment.

Pronotum: length 1 mm., width at base 1.71 mm., anterior angles .88 mm., collar .58 mm.; black, collar except at sides, slenderly on lateral and posterior margins of disk, lower pleural margin to top of coxal cleft, pale to ivory-white; disk moderately convex, closely and rather coarsely punctate, minutely pale pubescent; lateral margins practically straight, perceptibly carinate, anterior angles prominent, posterior angles rounded yet the nearest one-third of basal margin if projected would form a right angle with the lateral margin, the middle one-third slightly sulcate; calli confluent, forming a transverse slightly elevated area, impunctate, shining; propleura closely and coarsely punctate; xyphus distinctly convex, finely pale pubescent. *Scutellum* rather coarsely punctate except nearest the basal margin, black, narrowly at apex and more slenderly at basal angles ivory-white; mesoscutum moderately exposed, black, finely pale pubescent. *Sternum* and pleura black, ostiolar peritreme white.

Hemelytra: width 2.02 mm.; piceous to black, slightly translucent on basal one-fourth of embolium and a small spot near base of corium; glabrous or only minutely and sparsely pubescent, shining, closely and rather coarsely punctate, the heaviest punctures closely placed on the clavus; lateral margin of embolium slightly sinuate, minutely pubescent near the edge. *Cuneus* length slightly greater than width at base, punctate, black, pale and more or less translucent bordering the fracture and inner angle. *Membrane* clear, a distinct fuscous arc in the submargin of the apex, slightly darker at each side; veins fuscous, darker along apex of areoles, the infuscation invading the membrane slightly.

Legs: piceous to black, the femora becoming ferrugino-testaceous toward the apices, not distinctly annulated with paler, rather longly but finely pubescent,

especially on the anterior surface; tibiae triannulate with pale, a narrow basal band just below the knee, frequently nearly obsolete, the broadest band occupying the middle of the apical half; anterior face of tibia armed with a row of brownish spines, in length equal to diameter of the segment, also clothed with numerous rather stiff hairs chiefly shorter than the spines; tarsi blackish, the basal segment paler; claws deeply notched, piceous.

Venter: black, shining, moderately clothed with pale to yellowish pubescence or very fine hairs; genital claspers (Pl. X) distinctive of the species.

♀. Length 4.2 mm., width 2.05 mm.; slightly shorter and more robust than the male but very similar in structure and color; second antennal segment more slender, tapering from base to larger near apex, the middle one-third usually yellowish brown; apex of membrane frequently not so distinctly marked with fuscous.

Holotype: ♀ Aug. 10, Las Vegas, New Mexico (H. S. Barber); Cat. No. 6851, U. S. N. M. *Paratypes*: ♀ Aug. 2, ♀ Aug. 7, ♀ Aug. 8, Las Vegas, N. Mex. (H. S. Barber). Uhler records all four specimens as "secured Aug 10."

Allotype: ♂ Aug. 3, Grand View, Grand Canyon, Arizona (H. H. Knight); Cornell University collection. *Specimens examined* in addition to the types: ARIZONA,—2♂, 8♀ Aug. 2, top Bright Angel Trail, Grand Canyon; 3♂ 3♀ Aug. 3, Grand View, Grand Canyon (H. H. Knight). ♂ July 11, Williams (A. Wetmore). ♂ July 16, Williams (Barber & Schwarz). ♂ 2♀, Prescott. CALIFORNIA,—♀ April 27, Stanford (Harold Morrison). 3♀ April 12, Oakland (E. C. Van Dyke). ♀ July 14, Mt. Diablo (E. P. Van Duzee). ♂ 2♀, San Berdino (Coquillett). ♀ Jan. 1905, Menlo Park (F. Hornung). COLORADO,—♂ July 18, ♂ 2♀ July 20, Golden (W. J. Gerhard). ♀ April 20, Ft. Collins. ♂ July 9, ♀ July 28, Grand Junction. ♀, Grand Junction (H. Osborn). ♀ July 12, Denver; ♂♀ July 19, Manitou; ♂ July 21, Boulder; ♂♀ July 24, Salida (E. P. Van Duzee). NEW MEXICO,—♂ May 1, 2♀ June 1, Alamogordo. ♀ June 18, Cloudcroft. 2♂ June 2, Highrolls. ♂♀ May to Oct., Fort Wingate. 3♂ 10♀ June 23, Jemez Springs (J. Woodgate). OREGON,—♂ May 28, 1893, Mt. Tabor, Portland. BRITISH COLUMBIA,—♂ April 24, Victoria (A. E. Cameron). ♀ Victoria (G. W. Taylor). ♂ Aug. 9, Royal Oak (W. Downes).

An examination of the types proved this species to be something entirely different from that which the writer, working from the description alone, Reuter, and probably other workers took to be Uhler's *brevis*. The original description is misleading in describing the membrane as "soiled white" when all the type specimens show it to be infuscated in the usual understanding of the term. The species herein de-

scribed as *bakeri* n. sp. is the one that has usually been regarded as *brevis,* for it has a pale or "soiled white" membrane.

Deraeocoris (Camptobrochis) brevis piceatus new variety

Structurally very similar if not identical with *brevis* but differs at least in general color aspect; lateral margins of disk, base of embolium and corium, the clavus largely, pale to yellowish translucent; resembles *nubilus* in coloration but differs in having the central area of pronotal disk black with no indication of a pale median line.

♂. Length 4.8 mm. *Head*: similar to *brevis,* very pale forms may have the juga brownish but never connected with the pale vitta on front.

Pronotum: lateral margins more or less broadly pale, the central area of the disk black, the median line never pale.

Hemelytra: width 2.1 mm.; basal half of embolium and corium and sometimes extending along claval suture, clavus except along claval commissure, and base of cuneus, pale yellowish translucent.

Legs: more broadly pale than in *brevis* and frequently distinctly reddish.

Venter: black, in very pale forms sometimes reddish brown to piceous; genital claspers very similar to if not identical with *brevis.*

♀. Similar to the male in coloration, structurally not differing from *brevis.*

Holotype: ♂ July 24, Golden, Colorado (W. J. Gerhard); author's collection. *Allotype*: topotypic. *Paratypes*: CALIFORNIA,—1♂ 1♀ Aug. 20, Placer Co.; 2♂ Summit, Placer Co. (7,000 ft.); 4♂ 1♀ Aug. 24, Donner Lake, Placer Co.; ♂ ♀ Aug 21, Fallen Leaf, Eldorado Co.; 1♂ 2♀ June 17, Wawona, Mariposa Co. (W. M. Giffard). ♂ 2♀ July 9, Clayton, Shasta Co.; 2♂ 2♀ July 10, Huntington Lake; 2♀ July 23, McCloud, Siskiyou Co.; 3♂ 3♀ July 24, Sisson; 2♀ July 28, Mt. Eddy; 2♂ 1♀ Aug. 2, Hobergs, Lake Co. (E. P. Van Duzee). ♀ Aug. 21, Lake Tahoe (E. L. Diven).) 4♂ 2♀ Placer Co. (Uhler collection). ♂ 4♀ Oct., 1891, Lake Tahoe (Heidemann collection). COLORADO,—♂ July 28, Grand Junction. ♂ Grand Junction (H. Osborn). ♀ July, Cheyenne Canyon, Colorado Springs. 3♂ 4♀ July 24, Salida; ♂ April 27, Fort Collins (E. D. Ball). ♂ May 11, Graham's Park, Rio delos Pinos, on Salix bloom (C. F. Baker). IDAHO,—♀, Couer d'Alene (Uhler collection). MONTANA,—♂ 2♀ July 31, Missoula (A. A. Nichol). ♀ June 30, Bozeman. ♀ Sept. 6, Bear Paw Mountain. NEVADA,—♂♀ "Nev." (Uhler collection). OREGON,—♀ June 12, Josephine Co. (F. W. Nunenmacher). 2♀, "Oregon" (Koebele). ♀ June 10, Odell. 10♂♀ Dilley. WASHINGTON,—♂, "W. T." (Uhler collection). ♀ June 30, 1882, Lone Tree, Yakima River. BRITISH COLUMBIA,—4♀ July 20, Bear Lake; 3♀ Aug. 5, Kaslo (A. N. Caudell). 2♀ July 6, North Bend. ♀ May 20, Pendleton; ♀ June 4, Royal Oak (R. C. Treherne).

Deraeocoris (Camptobrochis) nubilus new species

Slightly larger than *nebulosus,* most closely related to *brevis* and *validus;* male more elongate than female, apical half of membrane infuscated, usually more so than in *brevis;* general coloration more nearly that of *validus* which species has the membrane merely tinged with fumate.

♂. Length 4.8 mm. *Head*: width .97 mm., vertex .38 mm., length .37 mm.; black, shining, line bordering front margin of eye, carina, juga, median line on front and on tylus, yellowish to ivory-white. *Rostrum,* length 1.75 mm., scarcely attaining the posterior margins of the middle coxae, piceous, slightly paler at the joints.

Antennae: segment I, length .31 mm.; II, 1.22 mm., nearly cylindrical, thickness .085 mm.; III, .40 mm.; IV, .42 mm.; uniformly blackish, pubescence fumate, last three segments beset with several longer infuscated hairs.

Pronotum: length 1.03 mm., width at base 1.7 mm., anterior angles .77 mm., collar .57 mm., nearly as in *brevis;* glabrous, shining, punctures black and prominent; calli confluent, impunctate, black, a pair of deep punctures just behind on the median line; collar pale, extending back from calli usually to basal margin of disk blackish, the lateral areas olivaceo-testaceous to grayish translucent, the median line always more or less pale. *Scutellum* punctate, black and shining, lateral margins basally and the median line apically, ivory-white. *Sternum* and pleura piceous, ostiolar peritreme white.

Hemelytra: width 2.02 mm., longer than in the female, uniformly olivaceo-testaceous or grayish translucent; punctures black, deep and moderately close, extreme outer edge of embolium and the commissure blackish. *Cuneus* punctured and colored as the corium, the apical half dark fuscous to black. *Membrane* infuscated, within the areoles, a transverse area immediately distad of the brachium and cuneus, hyaline.

Legs: posterior femora piceous, yellowish brown to reddish on the apical half and marked with two piceous bands, the extreme apex whitish; middle and front femora with the pale color restricted more to apices, trochanters testaceous; tibiae thrice annulated with fuscous and pale, fuscous band at the apex, middle and just below the knee, a fuscous spot on the knee but pale on the ventral side; tarsi fuscous to blackish, paler near the base.

Venter: black, shining, finely pale yellowish pubescent; genital claspers (Pl. X) distinctive of the species.

♀. Length 4.2 mm., width 2 mm.; shorter and more robust than the male; segment II, length .97 mm., shorter and more slender, nearly as in *brevis,* pale on the middle third; white before the calli and more extensively on the head and scutellum.

Holotype: ♂ Feb. 13, Ithaca, New York (H. H. Knight); author's collection. *Allotype*: same data as the type. *Paratypes*: 8♂ 13♀, taken with the types. CONNECTICUT,—♀ June 13, Rainbow (B. H. Walden), on white pine. DISTRICT OF COLUMBIA,—♂ July 4, ♂ Nov. 5, Washington (O. Heidemann). MASSACHUSETTS,—♀ Sept. 14, 2♂ Oct. 8, Forest Hills; ♂ Nov. 1, Northampton (H. M. Parshley). ♂♀ "Mass." (Uhler collection). ♂♀

July 11, Wellesley (E. P. Van Duzee). MINNESOTA,—♀ May 11, Taylor's Falls, on *Pinus strobus* (H. H. Knight). NEW HAMPSHIRE,—2♀ June 10, Claremont. NEBRASKA,—♀ Aug. 14, Sioux County. NORTH CAROLINA,—♂ July 19, Lake Toxaway (Mrs. A. T. Slosson). NEW YORK,—♀ May 20, ♀ June 14, ♂♀ June 30; ♂ July 8, 4♂ July 13, ♀ July 24, ♂ July 26, on *Pinus strobus;* 2♀ Nov. 6, (in house) Ithaca; ♀ June 22, Portage; ♀ July 14, Batavia (H. H. Knight). 6♂ 6♀ July 11, Taghanic (near Ithaca), taken on *Pinus resinosa* (H. H. Knight). ♀ April 19, (in house); ♀ Aug. 16, (at light) White Plains (J. R. Torre-Bueno). VIRGINIA,—♀ Oct. 5, (P. R. Uhler). NOVA SCOTIA,—♀ Sept. 13, Truro (R. Matheson). NEWFOUNDLAND,—♀ Stephenville, Bay St. George.

The writer found the types and a large series of specimens hibernating under the bark of a log where the insects had collected to spend the winter. When found, some were stiff with frost but soon revived as they were warmed in the sunshine. The writer has taken two specimens late in the fall as they came into buildings evidently seeking hibernation quarters. The species breeds on *Pinus strobus* and *Pinus resinosa* but only in favored spots on certain trees. One specimen was taken on larch, *Larix laricina,* but its occurrence on that tree may be merely accidental. The small white, wax-coated nymphs, were found in company with *Chermes pinicorticis* Fitch, resembling very much the wax-covered aphids. The bug is probably predaceous to a certain extent upon the pine bark aphid altho actual puncturing of an aphid was not observed.

Deraeocoris (Camptobrochis) nubilus obscuripes new variety

Structurally very similar if not identical with *nubilus,* but much darker in color, especially the legs.

♀. Length 4.3 mm., width 2.2 mm. *Head*: black, a small mark on median line of front and the jugae brownish, spot each side of vertex and more broadly along the carina pale.

Antennae: black, structurally not distinguishable from the typical form.

Pronotum: median line of disk reduced to a slender brownish line, lateral margins rather broadly brownish testaceous. *Scutellum* ivory-white at apex and basal angles.

Hemelytra: piceous, base of embolium and corium, central area of clavus, and base of cuneus, brownish testaceous.

Legs: black, hind femora with an obscure reddish black dorsal mark just before and at apex; tibiae with two obscure reddish brown annulations.

Holotype: ♀ June 30, Bozeman, Montana; author's collection.

Deraeocoris (Camptobrochis) nigrifrons new species

Slightly larger than *nebulosus,* very similar to but scarcely as large as *nubilus;* hemelytra of male short, similar to the female; frons black, apical half of membrane infuscated.

♂. Length 3.6 mm. *Head*: width .94 mm., vertex .43 mm., length .35 mm., black, shining; carina and in paler specimens a spot each side of vertex bordering eye pale; eye slightly smaller and less rounded than in *nubilus,* not occupying as much of the gena as in that species or *nebulosus. Rostrum,* length 1.34 mm., nearly attaining the posterior margins of the middle coxae, piceous.

Antennae: segment I, length .30 mm.; II, .91 mm., tapering to slightly thicker from base toward apex, attaining the thickness of segment I, pale yellowish pubescent and beset with several fine erect hairs which in length exceed the thickness of the segment; III, .39 mm.; IV, .37 mm.; black, the last two segments with erect pale hairs as in segment II.

Pronotum: length .91 mm., width at base 1.54 mm., anterior angles .91 mm., collar .67 mm.; nearly as in *nubilus,* the calli more distinctly swollen and confluent, without two deep punctures just behind on the median line; calli and posteriorly black, the median line slenderly pale. *Scutellum* nearly as in *nubilus,* lateral margins and sometimes the median line apically ivory-white. *Sternum* and pleura black, posterior and ventral margins of the epimera pale; ostiolar peritreme white.

Hemelytra: width 1.74 mm., short as in the female; olivaceo-testaceous or grayish translucent, corium except base and spot near tip of clavus, apex of embolium, commissure and more or less along base of clavus piceous, punctures black. *Cuneus* shorter than in *nubilus,* black, the basal half pale translucent, punctures black. *Membrane* infuscated nearly as in *nubilus.*

Legs: black, tips of coxae and margins of trochanters pale, apices of femora pale but with a black saddle-shaped spot over the dorsal half which viewed from above gives the appearance of two annulations; tibiae biannulate and with a third indication ventrally just below the knee, pale; two basal segments of tarsus largely pale.

Venter: black, shining, very finely pale pubescent; genital claspers (Pl. X) distinctive of the species, approaching *brevis* most closely.

♀. Length 1.37 mm., width 2.11 mm., very similar to the male but slightly more robust; very little paler than the male, the median line on pronotal disk usually more broadly pale while the femora are not so distinctly biannulate as in the male.

Holotype: ♂ August 3, Axiel, Colorado; author's collection. *Allotype*: August 24, Donner Lake, Placer County, Cal. (W. M. Giffard); collection of California Academy Sciences. ♂ ♀, taken with the allotype.

Deraeocoris (Camptobrochis) validus (Reuter)

1909 *Camptobrochis validus* Reuter, Acta Soc. Sci. Fenn., xxxvi, No. 2, p. 58.

Slightly larger than *nubilus,* brownish testaceous, calli black but without blackish rays posteriorly, median line of disk faintly indicated in paler; mem-

brane having only a transverse fumate cloud on the apical half which scarcely attains the margin.

♂. Length 1.6 mm. *Head*: width .94 mm., vertex .4 mm., length .48 mm.; carina present but low and broad, an impression each side on vertex curving forward to the median line, front less convex than in *brevis;* black, carina, along front margin of eyes but interrupted by a spot, juga, tylus except geminate mark on basal half and transversely just before apex, spot below base of antenna and frequently one on the genae, slender lower margin of bucculae, pale. *Rostrum,* length 1.51 mm., reaching upon middle coxae, brownish black, paler at the apex of first and second segments.

Antennae: segment I, length .34 mm.; II, 1.15 mm., nearly cylindrical but slightly more slender on the basal half, pale pubescent, beset with several erect dusky hairs which in length nearly equal thickness of segment; III, .4 mm.; IV, .37 mm.; black, the last two segments with a few fine hairs which are longer than the general pubescence.

Pronotum: length .97 mm., width at base 1.68 mm., anterior angles .84 mm., collar .66 mm.; disk moderately convex, rather coarsely punctate, especially just behind the calli and at each side, lateral margins slenderly carinate and slightly sulcate, the anterior angles distinct and not so broad as in *brevis* or *nubilus;* calli practically flat, separated by two coarse deep punctures, black, just before and somewhat invading the callus at the latero-anterior angle pale; disk brownish testaceous, the median line indicated by slightly paler, devoid of black behind the calli or on the basal angles; propleura brownish, paler on the ventral margin, dorsally either side of the coxal cleft blackish; xyphus pale, disk convex and infuscated, distinctly pale pubescent. *Scutellum* rugose-punctate, dark brownish, the punctures black, apex and the lateral margins basally ivory-white, the median line palely indicated. *Sternum* and pleura black, posterior and ventral margin of the epimera pale brownish; ostiolar peritreme white.

Hemelytra: width 2.05 mm.; scarcely differing from the female, brownish testaceous, rather uniformly black punctate, becoming piceous at apex of corium and a small inconspicuous spot at middle. *Cuneus* pale brownish translucent, punctures and the apex piceous. *Membrane* clear, brachium and slightly invading the membrane dark brownish, apical half with a transverse fumate cloud which scarcely attains the margin.

Legs: more or less pale and with piceous and black; posterior and middle femora broadly biannulate with piceous on the apical half, the basal half with two rows of spots on anterior face, a row of spots or a line on the dorsal surface; front femora black, biannulate with pale brownish near apices; tibiae triannulate with pale, the annulation just below the knee frequently interrupted by a piceous line on the dorsal side; tarsi pale, the apical segment and claws piceous.

Venter: black, shining, very finely pale pubescent; genital claspers (Pl. X) distinctive of the species.

♀. Length 4.8 mm., width 1.96 mm.; very similar to the male, median line of frons pale or brownish; segment II of antennae slender at base and tapering gradually thicker toward apex, not attaining the thickness of segment I, annulated with pale or brownish at middle.

Plesiotypes: ♂ May 3, Milpitas, California (R. J. Smith); ♀, Santa Clara County, California (C. F. Baker); author's collection. *Specimens examined*: CALIFORNIA,—2♀ September, Palo Alto (J. C. Bradley). ♀ Santa Clara County (C. F. Baker) [type material]. ♀ Aug. 2, Lakeport (E. P. Van Duzee). ♀, "Cal." (Uhler collection). OREGON,—♀ May 19, Dalles (U. S. N. M.).

The writer has not seen the type of this species altho type material has been studied. Dr. Philip A. Munz has been kind enough to furnish the writer with a list of the type specimens of Miridae which are found in the Pomona College collection. This list indicates that most of the types are contained there of species described by Reuter from the material collected by Prof. C. F. Baker. Of seven specimens from the type locality one is labeled "Camptobrochis" by Reuter but without specific name written out. This omission was probably due to an oversight which was never corrected following the description of the species.

No data are available regarding the food habits of the species, altho the May and September records indicate that the adults hibernate.

Deraeocoris (Camptobrochis) luridipes new species

Dorsal aspect very similar to that of *validus*, differs in having the apical half of membrane strongly infuscated and in the uniformly lurid or brownish femora.

♂. Length 4.8 mm. *Head*: width .97 mm., vertex .44 mm., length .54 mm.; nearly as in *validus* but the front is perceptibly more convex; carina distinct, indented just before; polished, black, the carina, a longitudinal median spot on front, bordering eyes and projecting slightly on vertex, jugae, spot at middle of tylus, pale yellowish. *Rostrum*, length 1.9 mm., barely attaining posterior margins of middle coxae; black, slightly brownish on under side at base and apex of segments I and II.

Antennae: segment I, length .4 mm.; II, 1.48 mm., gradually thickened from base (.057 mm.) to apex (.085 mm.); pale pubescent, the longest hairs equal to little more than thickness of segment; III, .51 mm.; IV, .40 mm.; black, perceptibly pale at tips of segments I and II.

Pronotum: length 1.14 mm., width at base 1.9 mm., anterior angles .88 mm., gently rounded; collar .65 mm., finely granulate, pale to yellowish; punctuation and surface similar to *validus;* calli black, the pale area just before and bordering the calli stained with brownish; disk uniformly grayish testaceous, devoid of black at the basal angles; propleura testaceous, pale bordering the coxal cavities, dorsally surrounding the coxal cleft and anteriorly to the stricture black; xyphus black, distinctly pale pubescent. *Scutellum* punctate, black, the side margins and apex ivory-white. *Sternum* and pleura black, slenderly brown along the suture separating the meso- and meta-pleural sclerites, pleura distinctly pale pubescent; ostiolar peritreme white.

Hemelytra: width 2.28 mm.; structurally very similar to *validus;* yellowish translucent, punctures black; bordering the commissure, a broad elongate spot occupying the apical half of corium, embolium toward the apex and slenderly along the outer edge, blackish. *Cuneus* testaceous, slightly translucent, punctures and the apical half black. *Membrane* distinctly fuscous on the apical half and projecting basally somewhat between the areoles, veins brownish black at apices of areoles, in darkest specimens somewhat invading the membrane; areoles within, bordering the veins without and at tip of cuneus, pale.

Legs: lurid to translucent brownish, anterior faces of femora with a linear series of fuscous points, the apices narrowly pale; tibiae indistinctly triannulate with paler; tarsi piceous, slightly brownish at base.

Venter: piceous black, shining; genital claspers (Pl. X) distinctive of the species.

♀. Length 4.8 mm.; very similar to the male, head more broadly pale and the corium with very little blackish.

Holotype: ♂ June 21, 1914, San Diego Co., Calif. (E. P. Van Duzee); collection of E. P. Van Duzee.

Allotype: same data as the type. *Paratype*: ♀, taken with the types. Mr. Van Duzee took the specimens on an "elderberry tree."

KEY TO THE SPECIES OF GROUP II

In this group the body form, genital claspers, and punctate scutellum all point to a close relationship with group I, while the non-cleft claws exhibit an affinity with the species of group V. *D. diveni* is very distinct and would merit the separation into a new group were other species discovered having similar characteristics.

1. Dorsum heavily pubescent or hairy 6
   Dorsum glabrous or practically so 2
2. Femora deep black, apices distinctly pale, tibiae biannulate with pale; pronotal disk of female largely pale, the calli and basal angles black; disk of male largely black, narrow median line and a stripe behind lateral angles of calli pale to brownish, black color on frons never forming transverse bars; dorsal width of an eye in the male not equal to width of vertex . . . . . *atriventris* n. sp. p. 112
   Femora not as the above, more or less brownish black or reddish, frequently biannulate with paler on the apical half; tibiae variously banded; dorsal width of an eye in male equal to width of vertex . 3
3. Femora narrowly pale at apex and a second band just before; hind tibiae distinctly biannulate, a third pale indication just below the knee; hemelytra more or less pale, apex, middle, and narrow base of corium blackish; cuneus black, pale on the basal half . *incertus* n. sp. p. 114
   Femora pale only at the very apex, or if a second annulation is indicated, then the cuneus reddish; hind tibiae biannulate or banded with pale only on the apical half; cuneus usually reddish, corium sometimes like the above 4

4. Femora uniformly reddish brown, indistinctly pale at the very apex; hind tibiae reddish brown, a single pale annulation on the apical half; hemelytra, cuneus, and pronotum distinctly tinged with reddish . . . . . *incertus carneolus* n. var. p. 116

   Femora black, sometimes with more or less pale; hind tibiae blackish, biannulate or with only a single pale band on apical half; hemelytra and pronotum not tinged with reddish, but pale with fuscous and black, cuneus either reddish or black at base 5

5. Hind tibiae black, distinctly annulated with pale on apical half only; femora black, slightly pale at tips; cuneus black, pale on basal half, frequently tinged with reddish . *incertus picipes* n. var. p. 116

   Hind tibiae blackish, biannulate with pale or even with a third pale indication below knee; femora brownish black, rather distinctly biannulate with pale on the apical half; cuneus red or brownish red . . . . . *rufusculus* n. sp. p. 116

6. Head black, pale color appearing along the median line of front; femora and ventral surface piceous, shining, tibiae biannulate with pale; slender elongate species, dorsum pitchy black and clothed with fine long pale hairs . . . . . *diveni* n. sp. p. 117

Deraeocoris atriventris new species

About the size of *brevis* or *nubilus,* dorsum glabrous, rather coarsely punctate, shining, second antennal segment longer than the head and pronotum taken together; femora black, only the apices pale, dorsum pallid grayish-testaceous and marked with black, much darker in the male.

♂. Length 4.7 mm. *Head*: width .98 mm., vertex .38 mm., length .48 mm.; carina delimited behind by a groove, sloping anteriorly to a pair of curved impressions on vertex, collum broadly exposed, vertex broader than the dorsal width of an eye; black, carina, spot each side of vertex and curving along front margin of eye, usually interrupted and leaving a spot just above base of antenna, and the juga, pale. *Rostrum,* length 1.84 mm., black, attaining the middle of hind coxae, first segment extending upon basal one-third of xyphus.

Antennae: segment I, length .34 mm.; II, 1.71 mm., nearly cylindrical, equal to segment I in thickness, pubescence pale and blackish mixed, a few black exserted hairs which in length are not equal to thickness of segment; III, .37 mm.; IV, .37 mm.; black, the last two segments slender and beset with several blackish exserted hairs which in length exceed the thickness of the segments.

Pronotum: length 1.08 mm., width at base 1.8 mm., anterior angles .74 mm., collar .65 mm.; disk convex, coarsely and rather irregularly punctate, lateral margins distinct, nearly straight, narrowed in front, the anterior angles little wider than the collar; calli black, shining, convex and confluent, delimited behind by coarse punctures, disk of each callus with three or four fine punctures near the latero-posterior angles; disk olivaceo-testaceous, basal angles broadly black, becoming black along the basal margin and irregularly among the punctures either side of the median line, frequently leaving a paler ray behind lateral angle of each callus, collar pale; propleura black, ventral and posterior margins more or less pale; xyphus black, moderately convex, collar pale.

Scutellum punctate, more coarsely and rugose-punctate on the basal half; black, the basal angles and apex ivory-white, mesoscutum black. *Sternum* and pleura black, opaque, the posterior and ventral margins of the epimera sometimes slenderly pale, ostiolar peritreme white.

Hemelytra: width 1.98 mm., brownish testaceous, strongly translucent, punctures black; spot at base, irregularly at middle and the apical area of corium, apex and slender lateral edge of embolium, bordering the commissure, black. *Cuneus* black, more or less pale at base, punctures black. *Membrane* fuscous on apical half, paler within the larger areoles and immediately distad of the brachium, brachium infuscated, the dark color invading the membrane slightly.

Legs: black, shining, tips of coxae and bases of trochanters pale, femora pale only at the apices; tarsi black, claws fusco-translucent, slender and not distinctly cleft; arolia very slender, bristle-like, erect and subparallel, converging slightly at apices (fig. 2, A).

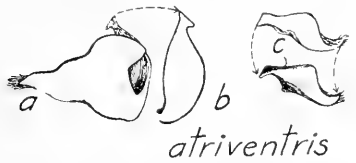

Fig. 3. *Deraeocoris atriventris*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: black, shining, pale pubescent; genital claspers (fig. 3) distinctive of the species.

♀. Length 4.8 mm., width 2.2 mm., more robust than the male; dorsum largely pale testaceous, calli and basal angles of pronotal disk black; hemelytra largely pale grayish testaceous, black spot at base and middle, but the blackish color at apex of corium more restricted than in the male; segment II, length 1.57 mm., slender, becoming gradually thicker toward apex, scarcely equaling the thickness of segment I, black, sometimes dark brownish at middle, pale pubescent, a few darker and longer hairs near apex.

Holotype: ♂ July 27, Mt. Lemon (alt. 9,000 ft.), Santa Catalina Mts., Arizona (H. H. Knight); Cornell University collection. *Allotype*: taken with the type. *Paratypes*: 46♂ 42♀ taken with the types.

All the specimens were taken on *Pinus scopulorum* and *P. arizonica* at the top of Mt. Lemon. Nymphs in the fourth and fifth nymphal instars were taken with the adults. A description of the fifth nymphal stage is as follows:

Length 3.3 mm., width (across wing-pads) 1.8 mm. *Head*: width .91 mm., vertex .48 mm., length .63 mm., more flattened and porrect than in the adult; carina not apparent, a row of small black bristles in its stead, triangularly impressed just before on the vertex; several large black bristles on front of head, one at base of jugum and two along lower half of front margin of eye which are most prominent; grayish testaceous, front mottled with fuscous each side of median line, geminate mark on basal half of tylus, along inner margin of eye and above base of antenna, blackish. *Rostrum*, length 1.57 mm., nearly attaining posterior margins of hind coxae, dusky to piceous.

Antennae: segment I, length .25 mm., thickness .09 mm.; II, 1.28 mm., thickness .09 mm., cylindrical, clothed, but not thickly set, with short stiff

black hairs, in length not equaling thickness of segment; last two segments mutilated; fusco-brownish, the basal segment more blackish.

Pronotum: length .65 mm., width at base 1.25 mm., width at anterior angles .83 mm.; disk nearly flat, more convex where the callosities are indicated, grayish testaceous, spotted and marked with fuscous, a row of black bristles on the anterior submargin; lateral margins nearly straight, beset with several bristles, basal margin sulcate at middle and broadly curving to the basal angles; propleura much reduced, coxal cleft distinct and cut well up under the lateral margin of disk, xyphus poorly developed. *Mesonotum* smooth, median line apparent as a fine impression which continues forward upon the pronotum; wing-pads reaching to posterior margin of the fourth visible abdominal segment, ground color similar to pronotum but more closely spotted with fuscous, the apical area, base, and the mesonotum largely clouded with fuscous; lateral margins of wing-pads beset with short stiff black bristles.

Legs: black, apices of femora pale; hind tibiae biannulate with pale, a third annulus indicated beneath the knee; front and middle tibiae more broadly pale, the three fuscous annulations much reduced, black on the knee; tibial comb fully developed and similar to that of the adult; tarsi two-segmented, the second segment three times the length of the first, blackish; claws as in the adult, arolia not distinguishable.

Abdomen: testaceous, ten segments visible from the dorsal aspect, a sparsely set row of black bristles transversely across the middle of each segment, each bristle usually arising from a fuscous spot; the third tergite and half of the fourth covered at middle by a conspicuous opaque blackish spot; tergites 5-8 with a dark opaque spot at each side in the lateral submargin, placed nearest the anterior margin of the tergite, the largest spot on the eighth tergite; spiracles situated on the ventral submargin and corresponding closely in position with the dorsal spots just described. The anus is provided with an eversible organ of sticky nature which enables the nymph, when disturbed and falling from one limb to another, to attach itself to the first object it strikes until such time as the feet can be brought into use again.

Deraeocoris incertus new species

Slightly larger than *atriventris*, femora biannulate with pale on the apical half; base, middle, and apex of corium piceous; eyes of male large, width of vertex not equal to the dorsal width of an eye; segment II of male antennae with fine short pubescence, devoid of exserted hairs.

♂. Length 5 mm. *Head*: width 1.06 mm., vertex .35 mm., length .54 mm.; carina much flattened, produced forward at the median line, a groove separating it from the collum; collum broadly exposed, black; eyes large, dark brown, nearly ovate when viewed from the side, much reducing the genal area; black, the pale markings very similar to those of *nubilus*, carina, bordering front margin of eye below vertex, median line of front below vertex and connecting beneath with juga, small spot below base of antenna, the median and a lateral line on tylus, pale or white. *Rostrum*, length 1.85 mm., reaching upon the hind coxae, piceous.

Antennae: segment I, length .34 mm., brownish black, paler on the apical half; II, 1.65 mm., cylindrical, equal in thickness to segment I, constricted at

base, black, finely pale pubescent; III, .43 mm.; IV, .43 mm.; last two segments slender, black, pale pubescent.

Pronotum: length 1.11 mm., width at base 1.82 mm., anterior angles .83 mm.; collar .68 mm., pale, opaque; disk moderately convex, glabrous, shining, rather coarsely punctate and especially so just behind the calli; lateral margins nearly straight, slenderly carinate, anterior angles narrowed, little wider than the collar; calli moderately convex, smooth and shining, confluent, delimited behind by an impression and also by coarse punctures; calli black but pale just before, median line but more broadly just behind calli, a rather broad ray behind lateral angle of each callus, and slender basal margin of disk, pale; propleura punctate, blackish, more or less pale around the margins; xyphus convex, blackish, the carinate lateral margins and in front on collar pale. *Scutellum* punctate, moderately convex, basal angles, apex, and usually the median line pale or ivory-white; mesoscutum black, distinctly exposed. *Sternum* black, opaque, only a spot at the dorsal margin of the episterna shining; ostiolar peritreme white, posterior and ventral margins of the epimera pale.

Hemelytra: width 2.14 mm., costal margin nearly straight or only very slightly arcuate; corium and clavus slightly more convex than in *atriventris*, coarsely punctate, more closely near the claval suture, glabrous, shining; pallido-testaceous, rather broadly across apex of corium and embolium, narrowly at base, a transverse blotch at middle of corium which continues along claval suture and across apex of clavus, piceous; punctures, slender edge of embolium and inner margins of clavus blackish. *Cuneus* pale, usually the apical half and the punctures blackish. *Membrane* pale fuliginous, apical half, the brachium and somewhat invading the membrane, infuscated, a clear spot bordering apex of cuneus.

Legs: apices of coxae and bases of trochanters pale, femora reddish brown or blackish, biannulate with pale at apices, front pair more distinctly so; hind femora usually more or less pale at middle on the anterior face; tibiae biannulate with pale, the hind pair with a third pale indication just below the knee, a row of spines on the anterior face; tarsi blackish, claws slender, not toothed at base, fusco-translucent; arolia simulating fine bristles, translucent, inclined forward between the claws, nearly parallel but converging slightly at tips.

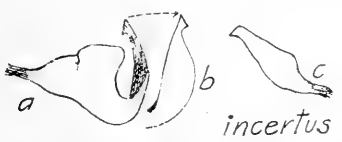

Fig. 4. *Deraeocoris incertus*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: black, shining, rather sparsely pale pubescent; genital claspers (fig. 4) distinctive of the species.

♀. Length 4.9 mm., width 2.37 mm.; very similar to the male but more robust, usually more broadly pale. *Head*: width 1.05 mm., vertex .44 mm., the dorsal width of an eye not equal to the width of vertex; median line of frons usually joined with the pale on vertex and carina, the black each side of frontal line frequently broken by transverse pale bars. *Antennae*: segment II, length 1.51 mm., slender and brownish on the basal half, distinctly thickened toward apex, a few exserted hairs equal to thickness of segment.

Holotype: ♂ August 12, Portland, Oregon (A. A. Nichol); author's collection. *Allotype*: taken with type. *Paratypes*: 3♀, topo-

typic. CALIFORNIA,—2♀ Aug. 24, Summit (alt. 7,000 ft.), Placer County (W. M. Giffard). ♀ July 28, Mt. Eddy (E. P. Van Duzee). BRITISH COLUMBIA,—♀ July, 1914, Vancouver (R. H. Crystal).

Deraeocoris incertus picipes new variety

♀. Length 5.5 mm., width 2.71 mm., larger than the typical *incertus,* vertex more distinctly indented but otherwise does not appear to differ structurally; femora uniformly piceous, slightly pale only at the very apex; hind tibiae black, distinctly annulated with pale only on the apical half; apical half of hemelytra more broadly piceous than the typical form, cuneus black, pale on basal half, frequently tinged with reddish.

Holotype: ♀ July 26, Webber's Camp (alt. 7,800 ft.), Santa Catalina Mts., Arizona (H. H. Knight); Cornell University collection. *Paratype*: ♀ Aug. 4, Williams, Arizona (H. H. Knight).

Both specimens were beaten from white oak *(Quercus sp.?)* but owing to the isolated specimens taken the occurrence on that tree may have been merely accidental. This form may prove to be distinct from *incertus* but in the absence of male specimens the identity can not be established with certainty.

Deraeocoris incertus carneolus new variety

♀. Length 4.7 mm., width 2.28 mm., nearly the size of the typical *incertus,* marked similarly to *picipes* but all the black color replaced by reddish brown and becoming piceous only in the darkest spots; vertex distinctly indented just before the carina; femora uniformly reddish brown, indistinctly pale at the very apex; hind tibiae reddish brown, a single pale annulation on the apical half; hemelytra, cuneus, and pronotum distinctly tinged with reddish, becoming brownish in the darker parts.

Holotype: ♀ August 2, Huachuca Mts., Arizona (H. G. Barber); author's collection.

Deraeocoris rufusculus new species

Closely related to *incertus,* smaller, darker colored, the cuneus red; segment II of antennae beset at intervals with erect hairs which in length equal the thickness of the segment; the genital claspers indicate a close relationship with *incertus* but certain differences are apparent (fig. 5).

♂. Length 4.9 mm. *Head*: width 1 mm., vertex .29 mm., length .57 mm.; vertex not equal to the dorsal width of an eye, carina low but apparent, arcuated cephalad, an oblique impression each side of vertex which unite on median line at base of frons; collum broadly exposed, a groove separating it from the carina; color markings nearly identical with *incertus. Rostrum,* length 1.98 mm., nearly attaining posterior margins of hind coxae, piceous.

Antennae: segment I, length .34 mm., fusco-brownish and somewhat translucent; II, 1.56 mm., brownish black, cylindrical, perceptibly thicker than segment I, constricted at base, clothed with fine dusky pubescence, beset at intervals with erect hairs which in length equal the thickness of the segment; III, .41 mm., slender, blackish, beset with erect hairs which in length exceed thickness of segment; IV, missing.

Pronotum: length 1 mm., width at base 1.68 mm., anterior angles .77 mm., collar .63 mm.; very similar to *incertus* except that the disk is more coarsely punctate behind the calli; dark brownish to black, shining, slender median line and the basal margin of disk pale or white, just before calli and an irregular spot behind the outer angles pale. *Scutellum* punctate, rather coarsely rugose-punctate on the basal half; dark brownish black, basal angles and apex ivory-white, median line palely indicated near apex. *Sternum* more brownish at the sides than in *incertus*.

Hemelytra: width 1.98 mm., similar to *incertus* except for the color; dark fusco-brownish, translucent, somewhat paler each side of the scutellum. *Cuneus* dark red, slender margin bordering the membrane dark brownish. *Membrane* marked similarly to *incertus* but the infuscation darker, invading the membrane more extensively each side of the brachium.

Fig. 5. *Deraeocoris rufusculus*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Legs: marked similarly to *incertus* but the dark color more brownish than black.

Venter: dark brownish to piceous, shining, rather sparsely pale pubescent; genital claspers (fig. 5) distinctive of the species.

Holotype: ♂ August 12, Portland, Oregon (A. A. Nichol); author's collection.

Deraeocoris diveni new species

Larger than *incertus*, and more elongate, black, shining, pale pilose above; median line of front and tylus and the tip of the scutellum more or less pale, tibiae biannulate with pale.

♂. Length 6.4 mm. *Head*: width 1.03 mm., vertex .45 mm., length .51 mm.; carina absent, vertex abruptly declivous behind, collum narrowly exposed; black, shining, tylus and juga distinctly pale pilose; median line of frons and spreading to form a triangle on vertex, more distinctly on median line of tylus, lower margins of bucculae and extreme tip of tylus, pale or white. *Rostrum*, length 1.85 mm., reaching upon the middle coxae, black, paler at apex of first and second segments.

Antennae: segment I, length .43 mm., strongly narrowed basally, longly pale pubescent on the apical half; II, 1.42 mm., thickness .10 mm., slightly thicker than segment I, nearly cylindrical but narrowed at base and slightly so at apex, black, the extreme tip white, pale pubescent, several exserted hairs slightly darker and in length exceeding the thickness of the segment; III, .52 mm.; IV, .45 mm.; black, the last two segments slender, beset with exserted hairs which in length are nearly equal to twice the thickness of the segment.

Pronotum: length 1.28 mm., width at base 2.05 mm., anterior angles .83 mm., collar .68 mm.; black, opaque; disk punctate, more deeply and coarsely behind the calli and laterally, longly pale pilose, more heavily at the sides, lateral margins distinct, nearly straight, distinctly narrowed at anterior angles, little wider than the collar; calli slightly convex, confluent, disk of each beset with four or five pilose hairs, a pair of large deep punctures just behind, one set each side of the median line; black, shining, basal margin narrowly pale; propleura black, coarsely punctate, pale bordering the coxal cavity, opaque each side of the coxal cleft; xyphus nearly flat, lateral margins much produced or carinate bordering the coxal cavity, black, opaque, pale in front on collar. *Scutellum* black, convex, apex sharply depressed and white; rather indistinctly rugose-punctate (badly injured by the pin, which prevents accurate judgment of the punctate character). *Sternum* and pleura black, granulate and somewhat wrinkled; ostiolar peritreme white.

Hemelytra: width 2.51 mm.; elongate, black, somewhat translucent, rather coarsely punctate; palely pilose, more thickly on embolium and base of corium. *Cuneus* black, pubescent, punctures distinct, pale spot at outer basal angle. *Membrane* infuscated, the brachium and within the areoles slightly darker, a clear spot bordering tip of cuneus.

Legs: black, tips of coxae and bases of trochanters pale; femora rather slender, tibiae biannulate with pale, devoid of spines except at apices but beset with several prominent hairs; tarsi black, slightly paler on the two basal segments which are practically subequal in length; claws slender, translucent, not toothed at base, arolia simulating fine bristles, pale translucent, inclined forward away from tarsus, nearly parallel but converging at tips.

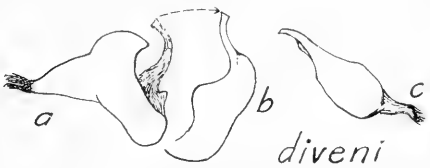

Fig. 6. *Deraeocoris diveni*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: black, shining, rather sparsely pale pubescent; genital claspers (fig. 6) distinctive of the species.

Holotype: ♂ August 26, 1915, Canon Camp (alt. 7,700 ft.), Yellowstone Park, Wyoming (E. L. Diven); author's collection.

This species is named in honor of the young and enthusiastic collector, Mr. Emerson L. Diven who lost his life August 7, 1919, in an airplane accident while scouting in the interest of the pink bollworm control in Texas.

Only the single specimen has been seen by the writer but it is very likely that more material can be obtained by beating conifers at the type locality or at similar altitudes in that general region.

KEY TO THE SPECIES OF GROUP III

1. Tibiae banded with fuscous or pale 2
   Tibiae uniformly pale or yellowish 9
2. Membrane with a distinctly rounded fuscous spot on the apical half, frequently connected at base by a fuscous streak extending down from

between the areoles, thus leaving a large pale spot each side of middle and bordering apex of cuneus 3

Membrane usually somewhat infuscated but not as described above . 4

3. Calli solid black, a broad piceous ray behind each; in pale specimens the calli may be somewhat brownish but in such case the median line and margins of the disk are distinctly pale, leaving a dark brown ray behind each callus; hemelytra with piceous on clavus and corium, embolium pale . . . . . *borealis* Van D. p. 120

Calli more or less invaded with brownish or pale, distinct rays not apparent behind calli; hemelytra and pronotum more uniformly colored, either fulvo-testaceous or dark brownish . . . . . *fasciolus* n. sp. p. 123

4. Rostrum extending slightly beyond the posterior margins of the hind coxae; membrane with the apical half scarcely infuscated, femora pale but with two distinct blackish bands near apices, hind tibiae biannulate with fuscous on the basal half . . *grandis* Uhler p. 126

Rostrum scarcely attaining the posterior margins of the hind coxae; membrane, femora, and hind tibiae not having the above combination of characters 5

5. Femora uniformly dark on the apical half, likewise the basal part in darkest specimens; venter distinctly reddish, sometimes dark chestnut red, shining . . . . . *betulae* n. sp. p. 129

Femora with the apical half distinctly banded or entirely pale . . 6

6. Second antennal segment with prominent pale exserted hairs, in length equal to three times the thickness of the segment; pronotum with discoidal margins pale, calli and posteriorly on disk black, frequently forming a ray behind each callus and thus leaving the median line pale 7

Second antennal segment without prominent exserted hairs, or if present, not equal to more than twice the thickness of the segment; pronotal disk without distinct rays, or if black then the lateral margins not distinctly paler 8

7. Median line of pronotal disk pale, the black color forming a distinct ray behind each callus; impressed spot each side of vertex next to eye, pale, frequently black just beneath the impressed spot and on front . . . . . *alnicola* n. sp. p. 132

Median line of pronotal disk not distinctly pale, sometimes the central area of disk may be paler than immediately behind the calli but a distinct median line is not formed; black spot, slightly impressed, one each side of vertex next to eye, the front more or less black, the median line usually pale . . . . . *shastan* n. sp. p. 133

8. Pronotum, sternum, and venter uniformly dark brownish black, a paler spot at the median line just in front of calli; disk of pronotum slenderly margined with pale; hemelytra brownish black, paler parts stained with brownish . . . . *triannulipes* n. sp. p. 137

Pronotum, sternum, and venter paler, usually pallid gray with fuscous, in darkest specimens blackish but the median line on pronotum and scutellum pale; hemelytra with infuscation appearing first at tip of embolium, on middle, outer margin at apex, and at base of corium, paler parts more or less translucent; darkest specimens becoming

blackish but the paler and translucent part not stained with brownish . . . . . *aphidiphagus* n. sp. p. 134

9. (1) Hind femora with two brown or fuscous bands near apices; apical half of the membrane with a distinctly rounded fuscous spot, usually connected at base by a fuscous streak which extends up between the large areoles 10

Hind femora with but one fuscous band; apical half of membrane pale or clouded with fuscous but the fuscous area not forming a rounded spot on the apical half 11

10. Calli solid black, a broad piceous ray behind each; in pale specimens the calli may be somewhat brownish but in such cases the median line and margins of disk are distinctly pale, leaving a dark brown ray behind each callus; hemelytra with piceous on clavus and corium, embolium pale . . . . . *borealis* Van D. p. 120

Calli more or less invaded with brownish or pale, distinct rays not apparent behind calli; hemelytra and pronotum more uniformly colored, fulvo-testaceous to dark brownish . *fasciolus castus* n. var. p. 125

11. Dorsum uniformly brownish black, or pronotum rich fulvous brown and the calli not margined or lined with black but uniformly colored as the disk of pronotum 14

Dorsum pale to testaceous and brownish, frequently becoming fuscous or blackish but always with some pale; calli margined with black or entirely black 12

12. Calli black only around the margin, dorsum rich brownish to fusco-brownish, shining . . *nitenatus* n. n. (=|| *nitens* Reut.) p. 141

Calli entirely black, or if not, then the dorsum pallid testaceous and with three irregular fuscous spots, one at apex, middle, and base of each hemelytron 13

13. Dorsum fuscous to blackish, usually with a pale median line running over the disk and scutellum, hemelytra darkened to such an extent that three fuscous spots are not apparent . . *quercicola* n. sp. p. 138

Dorsum pallid testaceous and with three irregular fuscous spots, one at base, middle, and apex of each hemelytron; calli usually black but in pale specimens only margined with black . . . . . *quercicola pallens* n. var. p. 140

14. Dorsum uniformly brownish black; calli and scutellum blackish similar to the whole dorsum . . . . . *davisi* n. sp. p. 140

Dorsum largely rich fulvous brown; calli not margined with black but uniformly colored as the disk of the pronotum; males becoming blackish on the basal half of the disk and on the anterior margin, while in darkest specimens even the calli may become dark but the scutellum always remains fulvous . . . . . *fulvus* n. sp. p. 144

Deraeocoris borealis (Van Duzee)

1920 *Camptobrochys borealis* Van Duzee, Proc. Cal. Acad. Sci., ser. 4, ix, p. 354.

Length 6-7 mm. Elongate, largely pale and marked with piceous; calli deep black, a broad piceous ray behind each, thus leaving the median line and margins of the disk pale or testaceous; embolium pale translucent, membrane

with a distinctly rounded fuscous spot on the apical half, usually connected at base by a fuscous streak extending down from between the areoles.

♂. Length 6.8 mm. *Head*: width 1.11 mm., vertex .52 mm., length .65 mm.; eyes ovate when viewed from the side, sloping, the lower margin somewhat removed from base of head; front broad, moderately convex, smooth and shining, lower part of face pubescent; carina flat, delimited behind by a groove which separates the black and broadly exposed collum from the vertex; median line of front pale, dark brownish to black at each side, frequently broken into transverse bars; base of tylus and a geminate mark on the basal half, above base of antenna, dorsal margins of lorae and bucculae, spot beneath eye, and narrow tip of tylus, blackish. *Rostrum*, length 2.28 mm., reaching to near posterior margins of the middle coxae, brownish, the apex becoming piceous.

Antennae: segment I, length .57 mm., scarcely reaching beyond tip of tylus by half its length, black, sometimes brownish black; II, 1.71 mm., nearly cylindrical, more slender at base, not equaling the thickness of segment I, rather thickly and longly pale pubescent, length of many hairs equal to twice the thickness of the segment, black, frequently brownish black at base; III, .74 mm.; IV, .56 mm.; last two segments slender, brownish to black, pale pubescent, many of the fine hairs equal to more than twice the thickness of the segment.

Pronotum: length 1.48 mm.; width at base 2.42 mm., anterior angles 1 mm.; collar .8 mm., opaque or dull brownish; disk moderately convex, black punctate, more coarsely just behind the calli, lateral margins distinct, slenderly carinate, nearly straight, narrowed until the anterior angles are little wider than the collar; calli moderately convex, smooth and shining, delimited posteriorly by an impression and coarse punctures, partially confluent but separated by a pair of deep punctures; calli deep black, also an arc projecting forward at the anterior angles, a broad piceous ray behind each callus extending to near the basal margin of disk, the median line broadly, lateral and basal margins of disk and just before the calli, pale to testaceous; propleura punctate, brownish, surrounding the dorsal half of the coxal cleft black and opaque; xyphus slightly convex anteriorly, pale yellowish brown, margins prominently carinate bordering the coxal cavity. *Scutellum* impunctate, convex, shining, pale to testaceous, a piceous vitta each side of median line at base, the piceous color frequently replaced by dark brown. *Sternum* black or brownish black, opaque, a small spot dorsally on the meso- and meta-episterna shining, basalar plate yellowish brown; ostiolar peritreme largely pale but becoming infuscated dorsally.

Hemelytra: width 2.85 mm.; moderately convex, margin of the embolium sinuate arcuate, cuneus and membrane moderately deflexed; glabrous, shining, black punctate; pale brownish translucent to dark brownish and piceous, embolium and narrowly at base of corium pale translucent, clavus dark brownish, more piceous on the basal half and at commissure, corium more or less piceous either side of the cubitus on the apical half. *Cuneus* pale translucent, punctures not evident except at base, apex blackish on the margin bordering the membrane. *Membrane* with a distinctly rounded fuscous spot on the apical half, usually connected at base by a fuscous streak extending down from between the areoles, thus leaving a large pale spot each side of middle and next to apex of cuneus; brachium infuscated, the infuscation invading the membrane each side, larger areole rather elongate and not broadly rounded apically.

Legs: pale testaceous, anterior face of coxae with prominent pale pubescence, ventral margin of femora beset with long pale pilose hairs; femora becoming darker near tips, usually banded twice on the apical half with blackish, in darkest specimens the hind pair frequently broadly black and the bands confluent; tibiae beset with stiff hairs but not with true spines except at tips, in dark specimens the hind pair may sometimes be annulated with fuscous on the basal half; tarsi infuscated at tips, first and second segments subequal in length; claws brownish translucent, deeply cleft or toothed at base, arolia simulating fine bristles, pale translucent, inclined forward, nearly parallel but converging slightly at apices.

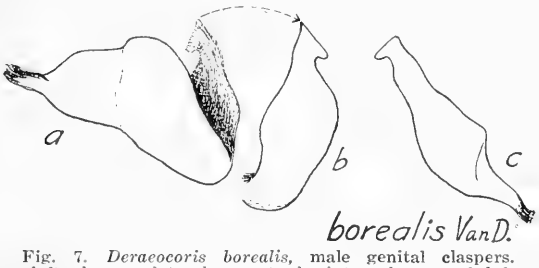

Fig. 7. *Deraeocoris borealis*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: dark brownish to piceous, shining, longly pale pubescent; genital claspers (fig. 7) distinctive of the species, the left clasper without a projecting horn at base.

♀. Length 6.4 mm., width 3 mm.; general coloration very similar to the male, the rays on pronotum sometimes more dark brown than piceous but rays are always apparent, in pale specimens the median line is always paler than at either side behind the calli; scutellum frequently dark brown each side of the median line rather than piceous, the black color on head and sternum much reduced also; segment II of the antennae slender, becoming thicker only on the apical one-fourth, black, sometimes brownish on the basal half, longly pubescent or hairy, length of exserted hairs equal to three times the thickness of the segment.

Plesiotypes: ♂♀ [*paratypes*] July 27, McLean, New York (H. H. Knight); author's collection. *Specimens examined*: *Paratypes*: 1♂ 1♀ July 9, Portland, Maine (E. P. Van Duzee). ♂ June 16, ♀ June 24, ♂♀ June 25, ♂ July 4, ♂ July 18, Batavia; 2♀ July 26, Ithaca; 2♀ June 27, Portageville; 3♀ July 27, McLean Bogs, Tompkins County, New York (H. H. Knight). *Records*: CONNECTICUT,—♀ July 6, South Meriden (H. Johnson). MAINE,—♂ June 26, ♂ July 31, Peaks Island (G. A. Moore). MASSACHUSETTS,—♂ Aug. 8, Chester (C. W. Johnson). MICHIGAN,—2♂ July 5, ♀ July 14, ♀ July 25, Cheboygan County (E. P. Butler). NEW JERSEY,—♂ 3♀ June 18, Hewitt (Wm. T. Davis). NEW YORK,—♀ July 8, Ithaca; 4♂ 2♀ July 3, McLean Bogs, Tompkins County (H. H. Knight). 5♂ 8♀ June 21, Olivera; 1♂ 1♀ July 4, Plattsburg (Wm. T. Davis). ♂ July 15, Wanakena; ♂♀ July 17, ♀ July 20, ♂ July 29, Cranberry Lake (C. J. Drake). ♂ June 24, Rockaway Beach, Long Island (C. E. Olsen). 3♂ July, Olivera (E. Shoemaker). OHIO,—♀ June

29, Delaware (C. J. Drake). WISCONSIN,—3♀ Aug. 12, Salmo, Bayfield County (W. L. McAtee). ONTARIO, CANADA,—3♂ July 3, Lake of Bays (J. McDunnough). NOVA SCOTIA,—♂, Halifax (E. P. Van Duzee).

The writer has taken this species on alders, a few specimens being collected on other plants but always in damp, cool, shaded situations. At the McLean bogs specimens were swept from aphid-curled leaves but the aphid was not identified. *Borealis* is doubtless predaceous to a large extent as is true of *alnicola,* the latter species apparently being confined to alders in its breeding habits. Both species are very similar in general coloration but structurally are very distinct.

Deraeocoris fasciolus new species

Slightly smaller than *borealis,* disk of pronotum more uniformly colored, distinct rays not apparent behind the calli; left genital clasper very similar to that of *borealis* but the right clasper is distinctive.

♂. Length 6.4 mm. *Head*: width 1.06 mm., vertex .51 mm., length .63 mm., structurally not differing appreciably from *borealis;* yellowish brown, spot each side of vertex, four or five transverse spots each side of median line of front, above and below base of antenna, base and apex and two longitudinal stripes on tylus, bucculae, tip of lorae and more or less on juga, blackish. *Rostrum,* 2.17 mm., reaching to near posterior margins of the middle coxae, yellowish to brownish, piceous at apex, the basal segment somewhat infuscated.

Antennae: segment I, length .54 mm., black; II, 1.57 mm., black, somewhat brownish at middle, pale pubescent, longest hairs scarcely equaling twice the thickness of the segment; III, .7 mm., blackish, paler at base; IV, .48 mm., blackish.

Pronotum: length 1.4 mm., width at base 2.28 mm., anterior angles .94 mm., collar .74 mm.; structurally very similar to *borealis,* disk more closely but irregularly puntate; calli dark brownish to black, invaded by pale or brownish at the latero-anterior angles; disk rather uniformly dark brownish, sometimes slightly paler on the central area but never forming distinct rays behind the calli, the lateral margins not at all paler than behind the calli. *Scutellum* impunctate, convex and shining, brownish, the basal angles and apex pale, median line brown, brownish black at each side but not attaining the base, the blackish color never beginning at base as is the case in *borealis. Sternum* brownish to black, always paler at the median line, basalar plate yellowish; ostiolar peritreme largely pale but becoming infuscated dorsally.

Hemelytra: width 2.77 mm., structurally very similar to *borealis;* rather uniformly dark brownish to piceous, paler on basal half of embolium and along base of cubitus. *Cuneus* pale translucent, fine infuscated punctures evident, apex more broadly infuscated than in *borealis. Membrane* nearly as in *borealis,* the rounded spot on apical half joined at base by a ray-like infuscation produced from the apical angle of each large areole, or in paler specimens not connected but the base of the apical spot not so clearly rounded as in *borealis.*

Legs: structurally as in *borealis;* pale to yellowish, femora biannulate with

blackish on the apical half, the front and middle pair paler on the ventral surface or the bands even obsolete above; tibiae with spot on knee and two annulations on basal half blackish, frequently the apices also darkened; tarsi dark brownish to blackish, darker at apices.

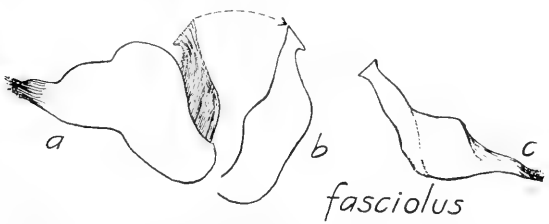

Fig. 8. *Deracocoris fasciolus*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: dark brownish to piceous, shining; genital claspers (fig. 8) distinctive of the species, the left clasper differing very slightly from that of *borealis*, but the much more bent and differently shaped right clasper is distinctive.

♀. Length 6.5 mm., width 3.1 mm.; very similar to the male in coloration but usually not so dark; segment II, length 1.63 mm., slender and only slightly thicker at apex, black, testaceous near middle but more broadly black at base than apex, clothed with fine pale hairs, length of several equal to more than twice the thickness of segment; paler specimens may have the front of head and calli more broadly brownish.

Holotype: ♂ July 8, Ithaca, New York (H. H. Knight); author's collection. *Allotype*: same data as the type. *Paratypes*: NEW YORK,—2♀ July 8, ♂ 2♀ July 26, ♀ July 23, Ithaca; ♂ June 30, 2♂ July 5, ♀ Aug. 10, ♂ Aug. 13, Batavia (H. H. Knight). ♀ June, ♂ July 2, Ithaca (W. H. Wellhouse), reared on Crataegus. ♂ July 26, Cranberry Lake; ♂ Aug. 1-7, Wanakena (C. J. Drake). ILLINOIS,—♀ June 29, Willow Springs (W. J. Gerhard). MAINE,—♂ July 12, ♀ July 28, Orono (C. W. Johnson). ♀, "Me." (Uhler collection). MASSACHUSETTS,—♂ Aug. 8, Chester (C. W. Johnson). MICHIGAN,—♂ July 11, North Muskegon (C. A. Hill). ♂ Aug. 28, Marquette. MINNESOTA,—♀ July 20, Gray Cloud Island; ♀ Aug. 18, Elkhorn Creek, Carlton Co.; 3♀ Aug. 30, Two Harbors; ♀ Aug. 20, Beaver Bay (H. H. Knight). 1♂ 1♀ July 11, Becker Co. (A. A. Nichol). OREGON,—2♀ Aug. 12, 2♀ Aug. 17, Portland (A. A. Nichol). WISCONSIN,—3♀ Aug. 12, Salmo, Bayfield Co. (W. L. McAtee). CANADA: BRITISH COLUMBIA,—3♂ 1♀ July 13, Kaslo (A. N. Caudell). NOVA SCOTIA,—♀ Aug. 12, Truro (R. Matheson). ♀ July 26, ♂ July 28, ♀ Aug. 11, ♂ Aug. 19, Smith's Cove (W. H. Brittain). ONTARIO,—♂ July 14, New Castle (L. Caesar), "on pear and apple." 3♂ 3♀ Aug. 6, Parry Sound (H. S. Parish). QUEBEC,—2♂ 1♀ July 22, Lacolle (G. A. Moore).

At Batavia the writer found this species on apple trees always closely associated with the rosy aphid, *Aphis sorbi* Kaltenbach. The

white wax-coated nymphs frequent the aphid-curled leaves, feeding on the aphids and honeydew excretions. The bugs were never observed to feed on the fruit and it seems to the writer that the species is likely to prove beneficial rather than injurious. The species was also taken on Crataegus, where it was found associated with and predaceous upon *Schizoneura crataegi* Oestlund. Dr. W. H. Wellhouse reared a specimen from the time of hatching to the adult stage on the foliage of Crataegus, altho in rearing other specimens he found that aphids were fed upon when available. The young nymphs appeared with the unfolding of the buds, doubtless hatching from eggs which passed the winter in the buds or twigs. Prof. L. Caesar found *fasciolus* rather abundant on apple and pear trees in Ontario but as yet has not observed it feeding on the fruit.

For a considerable period the writer had considered this species as merely a variety of *borealis* but a close examination of the genital claspers revealed the fact that *fasciolus* is structurally distinct, a point first suggested after observing the habits of these insects.

Deraeocoris fasciolus castus new variety

Apparently only a color form of *fasciolus* but at least a well defined and stable color variety; dorsum fulvo-testaceous, calli usually lined with black but sometimes entirely brownish.

♂. Length 6 mm. *Head*: width 1.08 mm., vertex .51 mm., length .57 mm.; fulvo-testaceous or brownish, basal spot and geminate mark on basal half of tylus, spot beneath eye, dorsal margin of lorae, mark on bucculae and tip of tylus, blackish. *Rostrum*, length 2.28 mm., nearly attaining the posterior margins of middle coxae, yellowish brown, the apex darker.

Antennae: segment I, length .57 mm., yellowish, becoming infuscated on basal half; II, 1.71 mm., pale yellowish, becoming infuscated at apex; III, .68 mm.; IV, .46 mm.; last two segments yellowish or becoming dusky.

Pronotum: length 1.45 mm., width at base 2.39 mm., anterior angles .92 mm., collar .74 mm.; uniformly fulvo-testaceous or brownish, calli lined with black, sometimes entirely brownish. *Scutellum* fulvo-testaceous, basal angles narrowly and sometimes the apex pale. *Sternum* uniformly brownish; ostiolar peritreme pale yellowish, fusco-brownish dorsally.

Hemelytra: width 2.85 mm.; uniformly fulvo-testaceous or brownish, embolium pale translucent, punctures black. *Cuneus* pale translucent, punctures not evident, fusco-brownish on the inner margin at apex. *Membrane* with a rounded fusco-brownish spot on apical half, sometimes produced basally in a ray between the larger areoles, brachium and invading the membrane either side fusco-brownish, in darker forms the areoles also clouded.

Legs: pale yellowish to brownish, sometimes the hind femora with two fuscous bands near apices; tibiae pale or with only a spot at knee; tarsi darkened at apices, claws brownish translucent.

Venter: testaceous to rich dark brownish, shining; genital claspers very similar if not identical with those of *fasciolus*.

♀. Length 6.5 mm., width 3 mm.; similar to the male in coloration; segment II, length 1.71 mm., pale yellowish, the apex infuscated.

Holotype: ♂ July 23, Ithaca, New York (H. H. Knight); author's collection. *Allotype*: same data as the type. *Paratypes*: 3♂ 16♀ taken with the types on beech, within leaves rolled by *Phyllaphis fagi* Linnaeus. NEW YORK,—2♀ July 8, 3♀ July 24, Ithaca; ♀ June 30, ♂ 3♀ July 5, 2♂ July 6, ♀ July 9, 3♀ July 14, ♂ July 15, 1♂ 1♀ July 22, ♂ July 25, ♂ Aug. 2, ♂ Aug. 3, Batavia (H. H. Knight). ♂ June 28, ♀ July 3, ♂ 3♀ July 15, Staten Island (Wm. T. Davis). 3♀ July 23, Staten Island (C. E. Olsen). MASSACHUSETTS,—2♂ 1♀ Aug. 8, Chester (C. W. Johnson). MICHIGAN,—1♂ 1♀ July 8, Holland (A. B. Walcott). NEW JERSEY,—♀ July 2, Jamesburg (Wm. T. Davis). OHIO,—♀ July 20, Columbus (E. Liljeblad). QUEBEC, CANADA,—♀ July 14, Montreal; ♀ July 30, Bondville (G. A. Moore).

This particular variety and only this form was found associated with and predaceous upon *Phyllaphis fagi* Linnaeus on the beech *(Fagus grandiflora)*, an aphid which rolls the leaves under tightly from the margin. Specimens of *castus* were taken at Batavia on apple trees with the typical *fasciolus*, which would indicate that both forms may occur in the same situation.

Deraeocoris grandis (Uhler)

1887 *Camptobrochis grandis* Uhler, Ent. Amer. ii, p. 230.

Length 6.4-7 mm. Distinguished by the long rostrum which reaches upon the second segment of the venter; dorsum rather uniformly dark brown, median line of pronotal disk rather broadly but only slightly paler than behind the calli; legs pale, apical half of hind femora and the basal half of tibiae biannulate with blackish.

♂. Length 6.4 mm. *Head*: width 1.03 mm., vertex .49 mm., length .67 mm., in profile more pointed, the base of tylus less prominent than in *borealis*, otherwise very similar in structure; yellowish brown, spot each side of vertex, irregular spots each side of median line, two longitudinal lines and base and apex of tylus, above and below base of antenna, bucculae and to some extent on juga and lorae, dark brownish to black. *Rostrum*, length 2.97 mm., reaching upon second segment of the venter, yellowish brown, darker at base and apex.

Antennae: segment I, length .52 mm., yellowish, becoming darker each side at base; II, 1.74 mm., yellowish, darkened on the apical one-third, scarcely equaling the thickness of segment I, tapering on basal one-third to slender at base, coarsely pubescent, a few exserted hairs nearly equal to twice the thickness of the segment; III, .72 mm., infuscated, yellowish toward base; IV, .51 mm., infuscated, slightly paler at base; the last two segments slender, several exserted hairs equal to twice the thickness of the segment.

Pronotum: length 1.42 mm., width at base 2.39 mm., anterior angles .97 mm.; collar .77 mm., dark brownish, opaque; disk moderately convex, coarsely black punctate, lateral margins slenderly carinate, slightly sulcate on the basal half, anterior angles narrow and rounding to the collar; calli slightly convex, smooth and shining, two punctures between at the median line, delimited behind by coarse punctures, black, yellowish brown just before on the median line; disk brownish to dark brown, usually slightly paler on the central area, the median line appearing broadly paler; propleura punctate, dark brownish, only slightly paler at the margins; xyphus nearly flat, fusco-brownish, coxal margins prominently carinate. *Scutellum* convex, smooth and shining, dark brown; basal angles, apex, median line on apical half, pale; mesoscutum dark brown, slightly paler at middle. *Sternum* dark brown to blackish, opaque except spot at dorsal margin of the meso- and meta-episterna; ostiolar peritreme pale, slightly infuscated at the dorsal margin.

Hemelytra: width 2.9 mm., structurally nearly as in *borealis;* brownish to dark brown, punctures black, paler parts as on embolium and small spot at base of corium stained with brownish. *Cuneus* pale and stained with brownish, apex and narrowly at base dark brownish, punctures black. *Membrane* uniformly pale fumate on the apical half; brachium, within the cells and slightly invading the membrane posteriorly, blackish.

Legs: legs pale, hind femora with two fuscous annulations on the apical half; tibiae banded with fuscous on the basal half, the middle and front pair distinctly annulated in darkest specimens; tarsi blackish at tips, claws stained with brownish, structure of the claws and arolia similar to *borealis.*

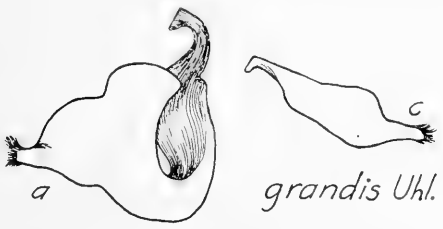

Fig. 9. *Deraeocoris grandis*, male genital claspers. a, left clasper, lateral aspect; c, right clasper, lateral aspect.

Venter: dark brownish to blackish, shining, clothed with rather long pale yellowish pubescence; genital claspers (fig. 9) distinctive of the species, the base of the left clasper prominent but not produced into a horn.

♀. Length 6.8 mm., width 3.1 mm.; general coloration nearly identical with the male, usually slightly larger in size; segment II, length 1.88 mm., slender, becoming gradually thicker from the base toward apex, not equaling the thickness of segment I, coarsely pale pubescent, a few hairs longer but scarcely equal to twice the thickness of the segment, yellowish, the apical one-fourth brownish black, the last two segments yellowish brown.

Plesiotype: ♂ July 14, Batavia, New York (H. H. Knight); compared with type; author's collection. *Allotype*: same data as the plesiotype. *Specimens examined*: NEW YORK,—♂ July 7, 10♂ 6♀ July 14, 1♂ 1♀ July 31, Batavia; ♀ July 16, Conesus Lake; ♂ June 30, Ithaca (H. H. Knight). ♀ August, West Hebron. ♀ June 19, ♂♀ July 3, White Plains (Torre-Bueno). 1♂ 1♀ July 24, Rockaway Beach, L. Is. (C. E. Olsen), collected in washup. ILLINOIS,—♂ May, "Ill." (C. A. Hart). MARYLAND,—1♂ 1♀ June 14, Beltsville (W. L.

McAtee). MASSACHUSETTS,—♂ July 18, Beach Bluff (H. M. Parshley). ONTARIO, CANADA,—♂ "Grimsby" (J. Petit).

In describing *grandis,* Uhler had under observation at least four different species and made allowance to cover all the forms he had seen of what he took to be merely variations. Nearly every species collected from the United States that is larger than *nebulosus* has at one time or another stood under that name. This condition doubtless resulted from the fact that in the past a hand lens furnished the only means of magnification for the study of specimens. Before the advent of the binocular microscope it was probably not even suspected that so many species of Deraeocoris could exist and yet be so similar in general appearance.

The writer has recently received from the National Museum through the kindness of Mr. E. H. Gibson and later by assistance of Miss Emma Wells, all the specimens from the Uhler collection that stood under the name *Camptobrochis grandis.* There are nine specimens and one pin upon which the specimen has been destroyed. The writer finds this material to be composed of the following: *Deraeocoris nitenatus,* ♂ Aug. 12, 1898, Madison, N. J., ♀, "Pa. 2151"; *D. fulvescens* (Reut.), ♀ May 8, Las Vegas, N. Mex. (Barber & Schwarz); *D. nigritulus,* ♀, District of Columbia (Pergande); *D. grandis* (Uhler) ♀, "Grimsby" [Doubtless: Grimsby, Ontario, Can., (J. Petit)], no date but identification label and locality in Uhler's handwriting; *D. aphidiphagus* n. sp., ♀ July 15, 1893, Glen Echo, Md.; *Lygus pratensis oblineatus* (Say), ♀ June 6, 1892, "Banft Sp Alb"; *D. barberi* n. sp., ♀ Aug. 13, Las Vegas, N. Mex. (H. S. Barber), labeled "*Camptobrochis grandis* var."; *D. borealis* (Van D.), ♀ Aug. 28, 1888, Marquette, Mich.; one pin with specimen destroyed, June 6, 1893, Glen Echo, Md.

The composite species, *grandis* Uhler, was described early in 1887 and the material from which the description was drawn must have been collected not later than 1886. In the Uhler collection the only possibility for a type is the specimen from "Grimsby" Ontario, Can. (J. Petit) without date, and judging by the age of the name label, in Uhler's handwriting, it must be the only specimen saved from those which served for the description of 1887. Since this specimen appears to be the only possible choice it seems advisable to designate it as the type. In reality the species is distinguished in the original description from the several closely related species, some of which were likewise included in the description, only by the long rostrum "reaching behind the posterior coxae," and the large size. Several

species were regularly determined as *grandis* by Uhler as witnessed by the above list found in the collection of that author. The writer's determinations for *grandis* until 1920, when the type was recognized, refer to two species, either *borealis* Van D. or *fasciolus* new species.

Lectotype: ♀, "Grimsby" [Ontario, Canada (J. Petit)]; Cat. No. 22684, U. S. N. M.

The writer took all his specimens on hickory *(Carya sp.)*, to which plant the species appears to be confined in its breeding habits. At Batavia, all the specimens were collected on young hickory trees, the first adult being taken on July 7, at which time several nymphs were found. The species is doubtless predaceous to a large extent as indicated by the fact that no injury to foliage was noted and specimens were not numerous on the most favorable growth of hickory. Specimens were scarce on July 31 and the disappearance of the species thereafter indicates that the winter season is passed only in the egg stage.

Deraeocoris betulae new species

Brown to dark brown or blackish, venter dark reddish brown to chestnut red; femora uniformly blackish on the apical half, tibiae triannulate with blackish.

♂. Length 6.7 mm *Head*: width 1.12 mm., vertex .54 mm., length .63 mm., tylus more prominent at base than in *borealis;* black, shining, in paler specimens the base of vertex, each side of front, spot at base of juga, paler; carina not evident, base of vertex delimited by a groove which separates it from the broadly exposed, black and shining collum. *Rostrum*, length 2.25 mm., reaching to near hind margins of the middle coxae, black, slightly paler at the joints.

Antennae: segment I, length .55 mm., II, 1.77 mm., nearly cylindrical, about equal to segment I in thickness, more slender on the basal one-fourth and slightly so at apex, dusky pubescent, exserted hairs not equal to twice the thickness of segment; III, .77 mm.; IV, .54 mm.; black, base of segment III narrowly brownish, the last two segments slender, beset with fine pale hairs which in length are equal to more than twice the thickness of segment.

Pronotum: length 1.48 mm., width at base 2.48 mm., anterior angles 1.03 mm.; collar .8 mm., brownish black, opaque; disk moderately convex, shining, coarsely and somewhat longitudinally strigate-punctate, more finely punctate near the basal margin, lateral margins distinct, straight, slightly rounded at the anterior angles; brownish black to black, calli smooth, confluent, extending forward to the constriction; propleura more finely punctate than the disk, brownish black, paler at the lower margins; xyphus convex in front, depressed behind, margins carinate at the coxal margin, pale to brownish, or fuscous. *Scutellum* impunctate, convex and shining, dark brownish to black, basal angles and apex paler. *Sternum* brownish black, opaque; ostiolar peritreme pale to brownish, becoming blackish at the dorsal margin.

Hemelytra: width 3.1 mm., structurally very similar to *fasciolus;* rather uniformly dark brownish or brownish black. *Cuneus* brownish black, punctures evident, slightly paler and translucent on the central area. *Membrane* strongly infuscated, a transverse pale area behind the areoles but usually interrupted at middle; the large fuscous spot occupying the apical half irregularly transverse at base, not so clearly rounded at the sides as in the case of *fasciolus.*

Legs: black, apical half of coxae, trochanters, and bases of femora more or less pale; tibiae black, paler at knee, annulus at middle of basal half and a much broader one just beyond middle of tibiae, pale; tarsi black, the second segment and base of third frequently paler; claws brownish to blackish, arolia slender, translucent, bristle-like, nearly parallel but converging slightly at apices.

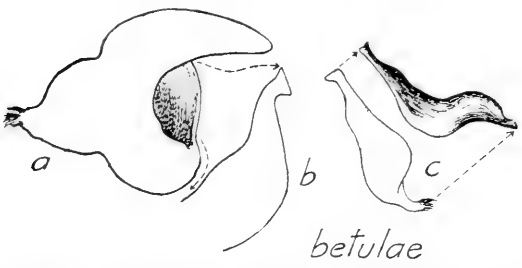

Fig. 10. *Deraeocoris betulae,* male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, dorsal and lateral aspect.

Venter: dark reddish brown to chestnut red or mahogany and piceous, shining, yellowish pubescent; genital claspers (fig. 10) distinctive of the species.

♀. Length 7 mm., width 3.2 mm.; usually somewhat paler in color than the male; front of head largely brown but with black spots each side of the median line. *Antennae*: segment I, black; II, 1.85 mm., slender, gradually enlarged toward apex, yellowish, the apical one-fourth black; the last two segments yellowish, darkened with fuscous apically. *Pronotum*: rich brownish to dark brown, calli black, lateral margins of disk slightly sulcate. *Scutellum* brown, becoming blackish each side of the median line. *Venter*: dark reddish or reddish brown, shining, frequently blackish surrounding the spiracles and at base of ovipositor.

Holotype: ♂ July 2, Ithaca, New York (H. H. Knight); author's collection. *Allotype*: taken with the type. *Paratypes*: 20♂ 21♀ taken with the types on *Betula lutea,* the large tree standing about forty feet up behind the Cornell University hydraulic laboratory. CONNECTICUT,—♀ July 2, New Haven (W. E. Britton). ♀ July 4, South Meriden (H. Johnson). MAINE,—♀ July 16, Wales (C. A. Frost). ♀ July 24, ♀ July 30, ♀ Aug. 4, Peaks Island (G. A. Moore). 3♂ 1♀ August, Mt. Katahdin, alt. 3,000 ft. (H. G. Barber). MASSACHUSETTS,—2♂ 1♀ July 18, Beach Bluff (H. M. Parshley). NEW HAMPSHIRE,—♀, Mount Washington; ♂, Franconia (Mrs. A. T. Slosson). NEW JERSEY,—♀ July 4, Hopatcong (H. G. Barber). ♀ July 6, Newfoundland (Wm. T. Davis). NEW YORK,—♂ June 23, 4♂ 2♀ June 30, 1♂ 1♀ July 2, Ithaca (H. H. Knight), on *Acer spicatum.* 2♂ 1♀ June 26, 3♂ 5♀ July 13, Ringwood, near Ithaca; 4♂ 5♀ July 3, McLean Bogs; 2♂ 4♀ July 4, Four Mile (H. H. Knight), all on *Betula lutea.* ♀ June 9, ♀ July 16, Staten Island; ♂ June 20,

Roseville; 2♀ Hamilton County; ♂ July 9, Whiteface Mt. (Wm. T. Davis). ♀ June 28, 5♂ 6♀ July 2, ♂ July 8, White Plains (J. R. Torre-Bueno). ♂ June 20, Ft. Montgomery (F. M. Schott). PENNSYLVANIA,—♂, Delaware Watergap (Mrs. A. T. Slosson).

Breeds chiefly on yellow birch, *Betula lutea,* the types and a good series being taken from one large tree, mostly from among clusters of aphid-deformed leaves. Nymphs as well as adults were taken on mountain maple, *Acer spicatum,* on the south shore of Beebe Lake, but collecting on the same plant at other localities failed to produce additional records. Caged specimens fed on sap of the host plant, altho observations made in the field point toward predaceous habits also.

Description of the fifth nymphal stage: ♀. Length 5.1 mm., greatest width 2.45 mm., more or less covered with a white, wax-like, flocculent material. *Head*: width 1.14 mm., vertex .65 mm., length .71 mm.; more flattened and eyes smaller than in the adult, vertex, front, and tylus beset with large stiff black bristles; pale testaceous and tinged with pink, eyes darkened. *Rostrum,* length 1.98 mm., reaching to middle of the hind coxae, pale, blackish apically.

Antennae: segment I, length .4 mm.; II, 1.31 mm., more slender than segment I, slightly thickened toward apex, rather sparsely beset with black bristles which in length are equal to twice the thickness of segment; III, .63 mm.; IV, .57 mm.; uniformly dusky or fuscous, the last two segments sparsely beset with hairs.

Pronotum: length .83 mm., width at base 1.57 mm.; anterior angles 1.03 mm., nearly in contact with eyes, front margin sulcate; basal margin nearly straight, rounded at basal angles, lateral margins distinct, nearly straight; disk slightly convex, sparsely beset with coarse black bristles, more prominent at anterior angles; propleura nearly vertical, coxal cleft prominent, xyphus convex, margins ecarinate; testaceous or dusky, darker on disk, the median line paler and continued upon the mesonotum. *Mesonotum* and wing-pads dusky, the latter darker toward apices, both pairs reaching to base of third tergite, sparsely beset with black bristles, larger at the lateral margins.

Legs: pale to reddish brown; femora reddish brown to blackish on the apical half, dusky or paler toward the base, dorsal surface beset with several stiff bristles; tibiae reddish brown to blackish, darkest specimens with an indistinct pale annulus on apical half, anterior surface with two rows or series of stiff bristles; tarsi two-segmented, blackish, claws blackish, arolia similar to those of the adult.

Abdomen: distinctly pink, paler at the margins, ten segments visible from the dorsal aspect, sparsely beset with bristles ranged in rows; third tergite with a dark median spot which also invades slightly the fourth tergite, darkest color inclosing two pore-like spots situated at the suture between the tergites; a row of dark spots situated each side on the submarginal area, a spot at the anterior margin of each tergite and becoming progressively larger distally; eight sternites visible, a spiracle situated each side in the sublateral area of the first seven; last two sternites infuscated along the median line, a longitudinal suture visible which is more evident on the last segment and appears

somewhat cleft at apex. In the male nymph the tip of the genital segment is less symmetrical, not cleft, the tip twisting slightly to one side and usually exposing a small chitinous blade, evidently the beginning of the left genital clasper.

Deraeocoris alnicola new species

General aspect very suggestive of *borealis* but distinguished by the genital claspers, prominent exserted hairs on antennae, and by paler infuscation of the membrane which does not form a distinctly rounded spot on the apical half.

♂. Length 6.5 mm. *Head*: width 1.08 mm., vertex .46 mm., length .57 mm.; structurally as in *borealis;* black, vertex, more or less each side of front, sides on basal half of tylus, gula, genae except spot beneath antenna, bucculae, lower margin of lorae, and narrow tip of tylus, pale to yellowish. *Rostrum,* length 2.17 mm., reaching to near posterior margins of middle coxae, yellowish brown, becoming piceous toward apex.

Antennae: segment I, length .45 mm., black; II, 1.6 mm., black, pale on the basal one-fifth, pale pubescent, exserted hairs long, some equal to three times thickness of segment; III, .63 mm., blackish, paler at base; IV, .48 mm., blackish.

Pronotum: length 1.42 mm., width at base 2.28 mm., anterior angles .97 mm., collar .74 mm.; calli black, invaded by pale at the antero-lateral angles each side of a black lunate mark which extends to anterior angle of disk; a broad widening piceous or black ray behind each callus, usually extending to basal margin of disk, the median line and basal margin narrowly, and the lateral margins more broadly, pale; propleura not so closely punctate as in *borealis,* yellowish brown, blackish surrounding top of coxal cleft. *Scutellum* impunctate, pale, a piceous vitta beginning at base and extending each side of median line to near apex. *Sternum* opaque, brownish black, paler at median line and margins; pleura dark brownish, paler at margins, basalar plate yellowish; ostiolar peritreme pale, darkened with brownish above.

Hemelytra: width 2.77 mm., structurally as in *borealis* but more broadly piceous on corium and apical half of embolium. *Cuneus* pale, punctures evident but blackish only at base, apex more broadly black than in *borealis. Membrane* pale, the apical half infuscated but not heavily so, the infuscation not rounded at sides but rather transverse at base, leaving an irregular transverse paler streak across middle of membrane; apical half of areoles and veins infuscated, a distinctly darker mark paralleling the brachium at apex of larger areole.

Legs: pale testaceous, apical half of femora blackish, forming two paler bands near apex; tibiae triannulate with blackish, in pale forms the apices paler; tarsi, claws and arolia as in *borealis.*

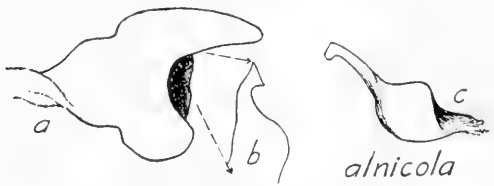

Fig. 11. *Deraeocoris alnicola,* male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: piceous, shining, pale yellowish pubescent; genital claspers (fig. 11) distinctive of the species, the left clasper with a prominent horn at base.

♀. Length 6.5 mm., width 2.9 mm.; general coloration similar to the male but slightly paler, usually with less piceous on the hemelytra, scutellum, and front of head; seg-

ment II, length 1.62 mm., slender, slightly thicker at apex, beset with prominent exserted hairs which in length are equal to three times thickness of segment, yellowish, usually darker at apex and sometimes slightly dusky near base; segment I paler at apex while the last two segments are paler than in the male; venter reddish to brownish and rarely with some piceous; apices of tibiae usually paler than in the male.

Holotype: ♂ July 3, McLean, New York (H. H. Knight); author's collection. *Allotype*: same data as the type. *Paratypes*: 30♂ 28♀, taken with the types on alders, *Alnus incana,* growing along the stream which flows out from the bogs. CONNECTICUT,—2♂ 3♀ June 19, Wallingford (J. D. Caffrey). ♂ June 20, New Haven (B. H. Walden). ♀ July 2, New Haven (W. E. Britton). 1♂ 1♀ July 3, Stonington (I. W. Davis). NEW YORK,—♂ 2♀ June 24, 2♀ July 5, Batavia; 2♀ June 27, Portage; ♀ July 27, McLean (H. H. Knight). 2♂ June 24, 2♂ 2♀ June 30, ♂ July 2, ♀ July 6, 2♂ 6♀ July 7, White Plains (J. R. Torre-Bueno). ONTARIO, CANADA,—3♂ July 1, Ottawa (H. G. Crawford). ♂ June 19, Hastings County (Evans).

The writer found this species only on alders, *Alnus incana,* but not in the same situations with *borealis.* On one occasion an adult bug was discovered feeding on a small adult Fulgorid, *Lamenia vulgaris* Fitch. Aphids and Psyllids were very abundant on the alders where *alnicola* was taken and both nymphs and adults doubtless feed to a considerable extent on these small insects.

Deraeocoris shastan new species

General aspect very similar to *alnicola* but the median line of pronotal disk not clearly defined with pale, disk more closely and finely punctate, abruptly convex at lateral margins, bucculae black while the juga are chiefly pale.

♀. Length 6.5 mm. *Head*: width 1.11 mm., vertex .55 mm., length .63 mm.; nearly as in *alnicola,* but genae broader and more tumid, front and vertex slightly more convex; pale to yellowish, black bars and spots each side of median line of front, black on the impressed spot at each side of vertex; base and two vittae on basal half of tylus, bucculae, dorsal margin of lorae, beneath base of antenna and more or less at apex of tylus, blackish, juga pale or only slightly dusky on its convexity. *Rostrum,* length 2.28 mm., reaching to near hind margins of middle coxae, yellowish brown, apex piceous; basal segment just attaining base of head, a black line each side of the suture.

Antennae: segment I, length .5 mm., brownish to fuscous; II, 1.48 mm., slender at base, tapering gradually to thicker at apex but not equaling the thickness of segment I, beset with several exserted pale hairs, the length of some equal to three times thickness of segment, fusco-brownish, slightly paler at extreme tip; III, .63 mm.; IV, .49 mm.; last two segments brownish to black.

Pronotum: length 1.4 mm., width at base 2.31 mm., anterior angles 1.11 mm., collar .85 mm.; lateral margins slenderly carinate, slightly sulcate, disk

abruptly convex from the lateral margin, central area somewhat flattened; disk more finely and closely punctate than in *alnicola;* calli convex, black, also a lunate mark which extends to anterior angle of disk, brownish black to black behind the calli; brownish on the central area of disk but the median line is not emphasized, lateral margins broadly pale; propleura pale, a blackish spot behind the coxal cleft on the lower half; xyphus yellowish, blackish each side behind the collar. *Scutellum* convex, smooth, somewhat depressed at middle of base, brownish black, basal angles and median line except at base pale. *Sternum* opaque, brownish black, the median line and margins paler; pleura dark brownish to blackish, paler at margins and on basalar plate; ostiolar peritreme pale, invaded with blackish above.

Hemelytra: width 2.9 mm., lateral margins more distinctly arcuate than in *alnicola;* black punctate, clavus brownish to blackish, darker at apex and bordering claval suture on basal half; embolium and lateral margin of corium except apex pale, broadly at apex and more or less connected with spot at middle of corium blackish. *Cuneus* pale, inner basal angle and the apex blackish. *Membrane* pale, brachium dark brownish, stained with fuliginous at either side, perhaps the apical half somewhat fuliginous in the male or darkest specimens.

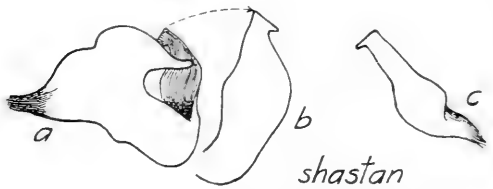

Fig. 12. *Deraeocoris shastan,* male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Legs: not differing appreciably from those of *alnicola.*

Venter: brownish with blackish, bordering the ovipositor and sutures of the genital segments, and surrounding the spiracles, blackish.

Holotype: ♀ May 28, Siskiyou County, California (F. W. Nunenmacher); author's collection. *Allotype*: May 20, 1920, Bryson, Monterey County, California (E. P. Van Duzee).

This species is named after the Shastan Indians, a tribe that inhabited northern California. The male specimen was received too late to serve for the description. It is slightly smaller than the female but very similar in coloration; genital claspers (fig. 12) distinctive of the species.

Deraeocoris aphidiphagus new species

1909 †*Camptobrochis grandis* Reuter, Acta Soc. Sci. Fenn., xxxvi, No. 2, p. 56.

Fusco-grayish to blackish, the paler and translucent parts not stained with brownish, apical half of membrane infuscated, tibiae triannulate with blackish; left genital clasper having a long horn at the dorsal margin; structurally as in *borealis* unless otherwise described.

♂. Length 5.9 mm. *Head*: width 1.08 mm., vertex .51 mm., length .57 mm.; pale, large spot each side of vertex, four or five transverse marks forming an arc each side of median line and sometimes meeting in front of ver-

tex, triangular spot at base and two longitudinal lines and apex of tylus, above and below base of antenna, gula, bucculae, dorsal margin of lorae, and somewhat on juga, fuscous to black. *Rostrum,* length 2.15 mm., scarcely attaining the posterior margins of the middle coxae, yellowish brown, darker at apex, basal segment blackish each side at middle.

Antennae: segment I, length .48 mm.; II, 1.48 mm., slender at base and gradually thickened toward apex, equaling the thickness of segment I, pale pubescent, length of longest hairs not equal to more than thickness of segment on apical half; III, .63 mm.; IV, .45 mm.; all the segments fuscous to blackish, segment III paler at base.

Pronotum: length 1.42 mm., width at base 2.39 mm., anterior angles 1 mm., collar .8 mm.; disk more closely punctate than in *borealis* or *fasciolus*, punctures delimiting posterior margins of calli more or less confluent, lateral margins slenderly carinate and perceptibly sulcate; calli slightly convex, separated by two closely set punctures at the median line, black, a lunate mark at the antero-lateral angles; grayish testaceous and more or less darkened with fuscous and black, the median line and the sublateral area of disk usually slightly paler; propleura blackish, dorsal, posterior and ventral margins more or less pale; xyphus pale to blackish. *Scutellum* smooth, convex and shining, brownish black, basal angles, apex, and median line pale. *Sternum* opaque, black, basalar plate yellowish to brown; ostiolar peritreme pale, becoming blackish above.

Hemelytra: width 2.9 mm., lateral margins very slightly arcuate; grayish translucent and darkened with fuscous and blackish, clavus darker along the sutures and at apex; embolium except at apex, spot at base of corium and bordering the embolium except at apex, pale translucent; spot at middle and more or less broadly on the outer apical area of corium piceous or black, punctures black. *Cuneus* pale translucent, punctures and apex black. *Membrane* pale fumate, apical half usually distinctly infuscated, brachium and more or less invading the membrane each side, fuscous.

Legs: pale, femora biannulate with fuscous or blackish on the apical half, frequently obsolete on the front pair; tibiae triannulate with fuscous or blackish, the apical annulus usually paler; tarsi pale to brownish, infuscated on apices; claws brownish translucent, arolia typical of the group.

Fig. 13. *Deraeocoris aphidiphagus*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: black, shining, sometimes with brownish near lateral margins, pale or yellowish pubescent: genital claspers (fig. 13) distinctive of the species, the long horn at the dorsal margin of the left clasper taken in combination with the comparatively slender internal arm is quite different from any other known species.

♀. Length 6.1 mm., width 3 mm., very similar to the male in structure and coloration: segment II, length 1.51 mm., slender, gradually thickened toward apex, scarcely equal to thickness of segment I, pale

pubescent, the longest hairs equal to little more than thickness of segment.

Holotype: ♂ July 24, Ithaca, New York (H. H. Knight); author's collection. *Allotype*: same data as the type. *Paratypes*: ARKANSAS,—2♂ 2♀ May 27, Fayetteville (G. G. Becker). 2♂ 2♀ May 15, 2♂ 1♀ May 20, Siloam Springs. COLORADO,—4♀ July 3, Fort Collins. CONNECTICUT,—♀ June 13, Wallingford (J. K. Lewis). DISTRICT OF COLUMBIA,—♂♀ May 30, 1879, ♂ June, 1885, Washington, "preying upon *Schizoneura americana*" (T. Pergande). ♀ June 10, Washington (O. Heidemann). ♀ June 25, Washington (Wm. T. Davis). ♂ July 6, Washington (W. L. McAtee). ILLINOIS,—3♂ 1♀ July 2, Willow Springs, (W. J. Gerhard). ♂ June 6, Angerville (J. R. Malloch). ♂, "N. Ill." (A. Bolter). ♂ June 16, 1885, Urbana (C. A. Hart). MAINE,—2♀ July 1, ♀ July 11, Orono (E. M. Patch). ♀ August, Mt. Katahdin, alt. 4,300 ft. (H. G. Barber). MARYLAND,—2♂ 3♀ July 15, ♀ Aug. 10, Glen Echo; ♀ June 15, Plummer's Island (O. Heidemann). ♀ June 10, Great Falls (F. Knab). ♀ June 4, Plummer's Island (W. L. McAtee). MICHIGAN,—2♂ 3♀ June 28, 1♀ July 1, Berrien County; ♂ June 18, Ann Arbor (R. F. Hussey). ♀ August, Marquette. MINNESOTA,—14♂ 20♀ June 29, Twin Lake, Martin County; ♂ July 13, St. Anthony Park (H. H. Knight). ♀ July 2, Mille Lacs County (V. R. Haber). ♂ 3♀ July 10, Rush Lake, St. Louis County (W. A. Riley). NEW HAMPSHIRE,—5♀, Fabyan. NEW YORK,—♂ 3♀ June 16, ♂ July 23, ♀ July 24, 1♂ 1♀ July 26, ♀ July 30, Ithaca; ♂ June 17, 2♂ July 7, ♀ July 12, 4♂ 3♀ July 14, ♀ July 27, Batavia; ♂ July 16, Conesus Lake; 2♀ July 27, McLean; ♂ July 27, Portageville (H. H. Knight). ♂ July 14, Lancaster (E. P. Van Duzee). ♀ July 14, White Plains (J. R. Torre-Bueno). OHIO,—2♂ 1♀ June 21, Mercer County (R. F. Hussey). NORTH DAKOTA,—♀ July 14, Kidder County (A. A. Nichol). SOUTH DAKOTA,—6♂ 4♀ June 30, ♀ July 11, ♀ July 13, ♂ July 15, Brookings (H. C. Severin). VIRGINIA,—1♂ 1♀ June 6, ♀ June 27, Mount Vernon (W. L. McAtee). ♀ May 30, Glen Carlyn (D. H. Clemens). ♂ July 7, Rosslyn (O. Heidemann). CANADA: ONTARIO,—♂ June 24, Trenton (Evans). ♂ July 6, Ottawa (J. Fletcher). NOVA SCOTIA,—2♂ 1♀ July 31, Truro (E. C. Allen). QUEBEC,—♀ July 13, Bord-a-Plouffe (G. A. Moore).

The writer has found this species breeding only on the elm *(Ulmus)* and in the curled leaves infested with *Schizoneura americana* Riley. Both nymphs and adults feed on the aphids and their honeydew excretions. The nymphs are coated with a white, wax-like material similar to that which covers the aphids, and in the early stages at

least are rather inconspicuous, as they live among the aphids and their excretionary products. The eggs are doubtless deposited during July in the twigs or buds, where they pass the winter, and upon hatching in the spring the young nymphs seek out the aphid-infested leaves very soon after the leaves are curled. In the writer's experience *aphidiphagus* was found closely associated only with *Schizoneura americana* but extended observations may show that other elm aphids are fed upon when the preferred species is not to be had.

Mr. Van Duzee writes that this species is the form which Reuter (1909) took to be *Camptobrochis grandis* Uhler and that he also has looked upon *aphidiphagus* as representing that species. The writer would call attention to the fact that until the present time the references to *grandis* Uhler refer to a group of species, as witnessed by numerous determinations examined, and should be accepted only with this in mind.

Deraeocoris triannulipes new species

Closely related to *aphidiphagus* but darker colored and the paler parts stained with brownish; genital claspers distinctive, the internal arm of the left clasper very different from that in *aphidiphagus*.

♂. Length 6.4 mm. *Head*: width 1.06 mm., vertex .54 mm., length .62 mm.; very similar to *aphidiphagus* but more broadly blackish at base of tylus and lower part of front, also blackish along front margin of eyes. *Rostrum*, length 1.99 mm., reaching to middle of intermediate coxae, yellowish brown, darker at apex.

Antennae: segment I, length .45 mm., fuscous to blackish; II, 1.51 mm., more slender on the basal half, the apical half scarcely equaling the thickness of segment I, pale pubescent, the length of a few exserted hairs slightly exceeding the thickness of segment, brownish black, paler on the basal one-third; III, .68 mm.; IV, .6 mm.; last two segments slender, brownish black, segment III paler at base.

Pronotum: length 1.34 mm., width at base 2.42 mm., anterior angles 1.03 mm., collar .8 mm.; uniformly brownish black, basal and lateral margins slenderly pale, brownish at the median line before the calli; xyphus and lower margins of propleura pale, fuscous mark each side at anterior angles of xyphus. *Scutellum* brownish black, basal angles, apex and a slight indication on median line pale; mesoscutum dark brownish. *Sternum* and pleura dark brownish black, basalar plate slightly paler; ostiolar peritreme pale, slightly darkened at dorsal margin.

Hemelytra: width 2.85 mm., nearly as in *aphidiphagus;* brownish black, basal half of embolium, spot at base of corium, and more or less on clavus, pale brownish translucent, the paler parts distinctly stained with brownish. *Cuneus* brownish black, more or less pale translucent at middle, the punctures dark. *Membrane* pale brownish or fumate, veins slightly darker, basal half of the larger areole and a spot at each side by apex of cuneus paler.

Legs: pale, femora more or less brownish black on the apical half, a pale band just before apex but interrupted on the anterior face, the basal half with a linear series of fuscous spots, the anterior pair more broadly pale; tibiae triannulate with brownish black, also with a spot at knee; tarsi yellowish brown, darker at apices, claws and arolia typical of the group.

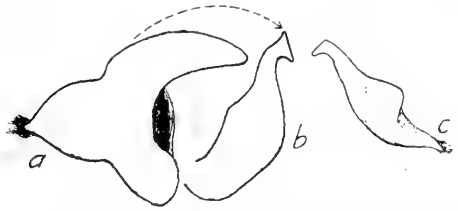

Fig. 14. *Deraeocoris triannulipes*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: black or brownish black, pale pubescent; genital claspers (fig. 14) distinctive of the species.

Holotype: ♂ Aug. 2, Rico, Colorado (E. D. Ball); author's collection. *Paratype*: ♂ Aug. 8, Husavick, Manitoba (Coates); collection of E. P. Van Duzee.

Deraeocoris quercicola new species

Darker colored than *nitcnatus*, fuscous to blackish, calli black, apical half of membrane fumate, rarely so pale as in *nitcnatus;* left genital clasper with a long dorsal horn which is very distinctive when taken in consideration with the form of the internal arm.

♂. Length 5.5 mm. *Head*: width .98 mm., vertex .45 mm., length .57 mm., structurally nearly as in *borealis;* pale to yellowish, collum, spot each side of vertex, arc each side of front composed of transverse bars and practically joining above, above and below base of antenna, geminate mark on tylus with spot at base and slightly at apex, bucculae and more or less on juga and lorae, black or brownish black. *Rostrum*, length 1.98 mm., attaining posterior margins of middle coxae, pale to brownish, darker at apex.

Antennae: segment I, length .46 mm., pale, darkened slightly with fuscous on basal half; II, 1.54 mm., nearly cylindrical, about equal to segment I in thickness, more slender on the basal one-fifth and very slightly so at tip, brownish, paler at base and brownish black on the apical one-fourth, pale pubescent, length of a few exserted hairs exceeding thickness of segment; III, .65 mm.; IV, .48 mm.; last two segments yellowish brown, becoming infuscated apically.

Pronotum: length 1.2 mm., width at base 1.99 mm., anterior angles .91 mm., collar .68 mm.; disk rather uniformly black punctate, lateral margins distinct, slenderly carinate, perceptibly sulcate, anterior angles slightly rounded; brownish black, frequently rather broadly paler along median line and on the lateral submarginal area; calli slightly convex, smooth and shining, black, pale just before but the dark color extending from the antero-lateral angles to front margin of disk, separated at base by a pair of punctures at median line; propleura brownish black, lower margin paler; xyphus convex anteriorly, pale, disk darkened with brownish or fuscous. *Scutellum* convex, smooth and shining, basal angles, apex and frequently the median line pale. *Sternum* and pleura brownish black, opaque, basalar plate more brownish; ostiolar peritreme white.

Hemelytra: width 2.4 mm., black punctate, moderately convex, lateral mar-

gins slightly sinuate; brownish black to piceous, darkest at middle and on outer apical half of corium; embolium except apically, spot at base and inner apical angles of corium, and clavus largely, pale brownish, translucent. *Cuneus* pale translucent, punctures black, apex broadly blackish. *Membrane* pale to fumate, slightly paler bordering tip of cuneus, veins brownish to fuscous, the dark color invading the membrane slightly at each side.

Legs: pale, hind femora with two blackish marks on the dorsal surface near apices; tibiae devoid of infuscations; tarsi infuscated at tips, claws and arolia typical of the group.

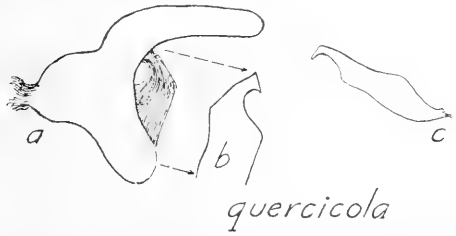

Fig. 15. *Deraeocoris quercicola*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: brownish black, shining, pale pubescent; genital claspers (fig. 15) distinctive of the species.

♀. Length 5.8 mm., width 2.82 mm., very similar to the male but slightly more robust, usually paler in color; calli black, disk of pronotum usually more brownish than blackish; scutellum sometimes only brownish but typically with a blackish vitta each side of median line; corium dark brownish to piceous on the middle and outer apical area; segment II, length 1.57 mm., slender, gradually thickened toward apex, pale or yellowish, becoming brownish at apex; femora frequently with only a brown mark on apical half.

Holotype: ♂ July 16, Conesus Lake, New York (H. H. Knight); author's collection. *Allotype*: same data as the type. *Paratypes*: 8♂ 5♀, taken with the types on *Quercus alba*. COLORADO,—♂ June 30, Fort Collins; ♀ July 19, Colorado Springs (E. D. Ball). CONNECTICUT,—2♂ July 8, New Haven. ♂ July, East River (C. R. Ely). DISTRICT OF COLUMBIA,—♀ June 22, Washington (Wm. T. Davis). ♀ July 2, Washington (O. Heidemann). GEORGIA,—1♂ 1♀ Clayton, alt. 3,000 ft. (Wm. T. Davis). ILLINOIS,—♂ June 3, ♀ June 8, ♀ July 9, Chicago; ♂ June 19, Glen Ellyn; ♂ June 24, Willow Springs (W. J. Gerhard). ♂ June 12, ♂ June 15, Champaign (C. A. Hart). ♀ July 6, Elizabeth (J. R. Malloch). INDIANA,—♀ June 9, Harrison County (H. F. Dietz). KANSAS,—♂ June, Lawrence (E. S. Tucker). MASSACHUSETTS,—♂ June 30, Arlington (G. W. Barber). ♀ June 26, Newton. ♂ July 16, Beach Bluff, ♀ July 28, Pigeon Cove (C. E. Olsen). ♂ July 18, Beach Bluff (H. M. Parshley). MICHIGAN,—3♀, "Mich." (Uhler collection). MINNESOTA,—♂♀ June 29, Twin Lake, Martin County (H. H. Knight). NEW JERSEY,—♀ July 25, Bear Swamp, Ramapo Mts. (Wm. T. Davis). ♀ July 4, Hopatcong; ♀ July 20, 7♀ July 25, ♀ July 27, Bear Swamp, Ramapo Mts. (H. G. Barber). NEW YORK,—1♂ 1♀ July 4, 2♂ July 5, Batavia; 2♂ July 4, Four Mile; ♂ June 21, 5♂ 2♀ June 27,

Portageville; 2♂ June 19, ♀ July 2, ♀ July 23, Ithaca (H. H. Knight). 1♂ 1♀ July 11, Massapegua, Long Island; ♀ July 7, Roseville; 2♂ June 21, Richmond; ♀ July 1, ♀ July 5, ♀ July 25, Staten Island; 2♂ June 19, 2♀ June 20, Pine Island (Wm. T. Davis). 2♂ July 2, 4♀ July 6, 2♀ July 18, White Plains (J. R. Torre-Bueno). 1♂ 2♀ July 4, Bayshore; 1♂ 3♀ July 4, Yaphank (C. E. Olsen). NORTH CAROLINA,—♀ June 25, Black Mts. (Beutenmuller). NEW MEXICO,—2♂ 1♀ July 12, 3♂ 2♀ Aug. 1, Jemez Springs, alt. 6,400 ft. (J. Woodgate). PENNSYLVANIA,—2♂ 1♀ Delaware Watergap (Mrs. A. T. Slosson). ♀, Jeannette (H. G. Klages). WISCONSIN,—1♂ 1♀ June 23, Beaver Dam (W. E. Snyder). CANADA: ONTARIO,—♂ "Grimsby" (J. Petit). QUEBEC,—♀ July 13, Bord-a-Plouffe (G. A. Moore).

Deraeocoris quercicola pallens new variety

♂♀. Structurally nearly identical with the typical *quercicola* but differs in color characteristics as follows: front of head pale or with the dark spots much reduced; calli frequently with pale on the disk of each, pronotal disk rather uniformly colored; scutellum pale, rarely with some blackish each side of the median line; hemelytra pale to yellowish, corium with a spot at middle, small one at base, and irregularly at apex, blackish.

Holotype: ♂ Aug. 12, Batavia, New York (H. H. Knight); author's collection. *Allotype*: same data as the type. *Paratypes*: 2♂ 7♀ taken with the types on *Quercus macrocarpa*. COLORADO,—♀July 19, Colorado Springs (E. D. Ball). MINNESOTA,—3♂ 5♀ June 18, 2♂ 3♀ June 21, 4♀ Aug. 11, St. Anthony Park; 2♀ July 20, Gray Cloud Island; ♂ 6♀ Twin Lake, Martin Co. (H. H. Knight). NEW MEXICO,—3♀ Aug. 1, Jemez Springs (J. Woodgate). NEW YORK,—♂ July, 1886, Buffalo (E. P. Van Duzee). ♂ 4♀ July 4, 3♀ July 12, ♂ July 13, ♂ 3♀ July 14, Batavia (H. H. Knight).

Apparently only a color variety of *quercicola* but one which the writer has found rather consistently on *Quercus macrocarpa*. The color pattern is fixed shortly after the adult emerges and is retained throughout the life of the insect. Tenerel forms of the typical species pass through the color stage represented by *pallens* but when allowed to live, the darker colors are developed and fixed within a few hours after emergence.

Deraeocoris davisi new species

Slightly smaller than *nitenatus*, uniformly brownish black, legs and antennae chiefly pale; genital claspers very distinctive, nearest to *quercicola* but the internal arm of the left clasper more highly developed.

♂. Length 5.3 mm. *Head*: width 1.01 mm., vertex .43 mm., length .54 mm.; brown and marked with brownish black, dark markings similar to those of *quercicola* except that the blackish color each side of front is not broken into transverse bars. *Rostrum,* length 1.92 mm., nearly attaining the posterior margins of middle coxae, yellowish brown, darker at apex.

Antennae: segment I, length .45 mm., yellowish, darker on ventral side of basal half; II, 1.37 mm., equal in thickness to segment I, slender at base, tapering slightly at apex, pale pubescent, length of exserted hairs exceeding thickness of segment, yellowish, becoming brown on the middle one-third; III, .54 mm., yellowish, fuscous toward apex; IV, .43 mm., fuscous.

Pronotum: length 1.22 mm., width at base 2.11 mm., anterior angles .94 mm., collar .73 mm., brownish black, opaque; disk closely punctate, more coarsely behind the calli, lateral margins slenderly carinate, nearly straight, anterior angles gently rounded; uniformly brownish black, calli and anterior portion slightly darker, slender basal margin slightly pale; propleura with ventral and posterior margins paler, xyphus yellowish. *Scutellum* convex, smooth and shining, deep brownish black, small spot at tip and narrowly at basal angles, yellowish brown. *Sternum* dark brownish to blackish, paler at the median line; ostiolar peritreme pale to yellowish.

Hemelytra: width 2.51 mm., structurally as in *nitenatus;* brownish black, basal half of embolium and a small spot near base of corium brownish translucent. *Cuneus* dark brownish, brownish translucent across the middle. *Membrane* nearly as in *nitenatus,* the apical half sometimes very faintly and uniformly stained with brownish, veins and areoles darkened with brownish.

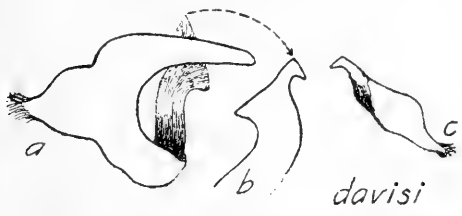

Fig. 16. *Deraeocoris davisi,* male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Legs: pale or yellowish, the hind femora marked on the apical half with an incomplete band as in *nitenatus;* tarsi slightly brownish at apices.

Venter: brownish black to piceous, pale yellowish pubescent; genital claspers (fig. 16) very distinctive of the species.

Holotype: ♂ June 22, Staten Island, New York (Wm. T. Davis); author's collection. *Paratypes*: ♂ June 18, ♂ June 22, ♂ June 23, Staten Island, New York (Wm. T. Davis). ♂ May 11, Spring Hill, Alabama (H. P. Loding).

Deraeocoris nitenatus new name

1909 *Camptobrochis (Euarmosus) nitens* Reuter, Acta Soc. Sci. Fenn., xxxvi, No. 2, p. 56. (name preoccupied)

1910 *Camptobrochis nitens* Banks, Cat. Nearc. Hem. Het., p. 43.

1916 *Camptobrochis grandis* var. *nitens* Van Duzee, Check List Hemip., p. 41.

1917 *Camptobrochis grandis nitens* Parshley, Occas. Papers Bost. Soc. Nat. Hist., vii, Faun. N. Eng., 14, p. 93.

1917 *Camptobrochys grandis* var. *nitens* Van Duzee, Cat. Hemip., p. 356.

General aspect very similar to *quercicola* but differs as follows: more highly polished, calli black around the margins only, dorsum rich brownish to dark brownish and piceous, frequently brownish on scutellum but rarely blackish each side of median line; brachium and apices of the areoles dark fuscous while the apical half of membrane is practically clear; male genital claspers very distinctive.

♂. Length 5.7 mm. *Head*: width 1.01 mm., vertex .45 mm., length .57 mm.; tylus slightly more prominent but the infuscations are nearly identical with *quercicola*. *Rostrum,* length 1.94 mm., nearly attaining posterior margins of middle coxae, pale yellowish, piceous at apex.

Antennae: segment I, length .48 mm., yellowish, irregularly infuscated on basal half; II, 1.45 mm., yellowish, darkened at apex; III, .68 mm.; IV, .56 mm., comparatively longer than in *quercicola;* last two segments yellowish to fuscous.

Pronotum: length 1.28 mm., width at base 2.2 mm., anterior angles .88 mm., collar .71 mm.; disk more coarsely punctate on the basal half, dark brownish to piceous, darker on the basal half either side of the median line; calli slightly convex, piceous on the front and hind margins, the disk of each paler and connected at the latero-anterior angles with the pale color just in front; propleura closely punctate, yellowish brown, blackish and opaque surrounding the coxal cleft; xyphus pale to brownish. *Scutellum* strongly convex, polished, pale, frequently becoming reddish or brownish each side of the median line, very rarely with blackish. *Sternum* and pleura brownish black, opaque; ostiolar peritreme white.

Hemelytra: width 2.04 mm., structurally as in *quercicola;* apical half of corium and invading the embolium piceous, the clavus and a spot each side of apex on the corium, basal half of embolium, spot near base of corium, pale to brownish translucent. *Cuneus* pale translucent, punctures black, yellowish brown at apex and becoming fuscous at the inner margin where the brachium joins. *Membrane* clear or practically so, brachium and apices of the areoles dark fuscous; apical half of membrane distinctly clearer than in *quercicola.*

Legs: pale, hind femora with a brownish black mark on the anterior face of apical half, sometimes indicated on the middle pair; tips of tarsi fuscous, claws brownish translucent, arolia typical of the group.

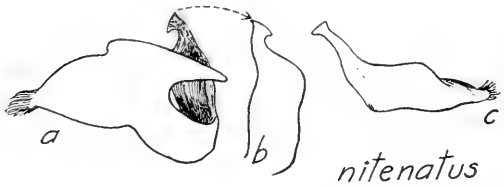

Fig. 17. *Deraeocoris nitenatus,* male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: brownish to reddish brown and piceous, shining, finely pale yellowish pubescent; genital claspers (fig. 17) distinctive of the species.

♀. Length 6 mm., width 2.9 mm., very similar to the male but usually more robust; segment II, length 1.51 mm., slender, slightly enlarged on the apical one-fourth, yellowish,

becoming brownish at apex, exserted hairs prominent, in length equal to more than twice greatest thickness of segment.

Plesiotypes: ♂ July 22, Cold Spring Harbor, New York; ♀ Sept. 27, Northampton, Mass. (H. M. Parshley); compared with type; author's collection. *Lectotype*: ♂ June 25, 1904, Washington, D. C. (O. Heidemann); Cat. No. 24169 U. S. N. M. This specimen bears a Reuter label "*Camptobrochis n. sp.*" and is the second specimen mentioned under the original description. *Specimens examined*: CONNECTICUT,—♂ Aug. 14, New Haven (W. E. Britton). DISTRICT OF COLUMBIA,—♂ May 11, 2♀ June 28, 3♂ 4♀ June 30, 2♂ 1♀ July 8, 3♀ July 20, 1♂ 1♀ Aug. 2, Washington (O. Heidemann). ILLINOIS,—♂ July 24, Galesburg (Stromberg). MARYLAND,—2♀ June 15, Beltsville (W. L. McAtee). ♂ Aug. 3, Forest Glen; ♂♀ Henson Creek (O. Heidemann). ♀ Sept. 2, Plummer's Island (H. L. Viereck). MASSACHUSETTS,—♀ Sept. 15, Blue Hills; ♂ Sept. 17, Forest Hills; 1♂ 1♀ Sept. 7, Saugus (H. M. Parshley). ♂ July 29, Pigeon Cove (C. E. Olsen). ♀ Aug. 20, Farmington (C. A. Frost). ♂ July 30, Auburndale. 2♂ Aug. 5, Brookline. ♀ Sept. 5, Wood's Hole. MINNESOTA,—2♂ July 20, Gray Cloud Island; 1♂ 1♀ July 29, St. Paul, predaceous on *Schizoneura lanigera,* which makes a rosette gall of elm leaves; 4♂ 8♀ Aug. 5, St. Anthony Park, on *Quercus macrocarpa* (H. H. Knight). NEW JERSEY,—♂♀ July 27, Bear Swamp, Ramapo Mts. (H. G. Barber). NEW YORK,—♂ July 22, ♂ July 26, 2♂ July 29, 2♂ Aug. 4, Cold Spring Harbor (H. M. Parshley). ♂ July 24, ♂ July 29, Ithaca (H. H. Knight). ♂ July 27, Aqueduct; ♀ July 23, 1♂ 1♀ Aug. 1, ♀ Aug. 3, ♀ Aug. 12, Staten Island (Wm. T. Davis). ♀ July 31, Bayshore; ♂ July 18, ♀ Aug. 1, Maspeth; ♀ Aug. 7, Roslyn; ♂ 2♀ July 23, Staten Island (C. E. Olsen). ♂ July 18, 3♀ July 27, 2♂ 1♀ Aug. 14, White Plains (J. R. Torre-Bueno). ♀ July 14, Lancaster (E. P. Van Duzee). NORTH CAROLINA,—♂ June 25, Black Mts. (Beutenmuller). PENNSYLVANIA,—♀ Sept. 8, Central (Wm. T. Davis). ♂ July 5, Harrisburg. ♀ Aug. 6, Twin Lakes (C. L. Pollard). ♂, Delaware Watergap (Mrs. A. T. Slosson). VIRGINIA,—♀ July 30, Great Falls (H. G. Barber). CANADA: QUEBEC,—♂ Aug. 10, Lachine (G. A. Moore).

The writer found this species to be predaceous on *Schizoneura lanigera* (of Patch) which makes a rosette gall of elm leaves. It was, however, never found in company with *D. aphidiphagus* which develops with and is predaceous upon *Schizoneura americana* Riley. Mr. C. E. Olsen states that he also has observed *nitenatus* to be predaceous on elm aphids which formed a rosette gall. Specimens were taken

August 5 by beating the limbs of *Quercus macrocarpa,* and the isolated occurrence suggests that *nitenatus* is predaceous upon plant lice or other small soft-bodied insects on that tree. Dr. H. M. Parshley collected adults from among the nymphs of *Corythucha associata* O. & D. on wild cherry, but the true relationship between the forms was not determined.

Deraeocoris fulvus new species

Smaller than *nitenatus,* fulvous to piceous, male becoming piceous on pronotum and hemelytra, female piceous only at inner apical angles of corium.

♂. Length 4.3 mm. *Head*: width .88 mm., vertex .4 mm., length .43 mm.; base of vertex slightly elevated to form a carina which extends higher than the black and broadly exposed collum; luteous to brownish, polished, bordering inner margins of eyes and extending slightly upon vertex, geminate mark on basal half of tylus, genae, dorsal margins of bucculae and lorae, somewhat on juga and the tip of tylus, blackish. *Rostrum,* length 1.48 mm., reaching to near posterior margins of middle coxae, yellowish, dark brown at apex.

Antennae: segment I, length .34 mm.; II, 1.2 mm., cylindrical, thicker than segment I, abruptly slender at base and slightly so at apex, pale pubescent, length of exserted hairs scarcely equal to thickness of segment; III, .44 mm.; IV, .33 mm.; yellowish, the apex of segment II very little, if any, darker, the last two segments slightly dusky.

Pronotum: length .97 mm., width at base 1.71 mm., anterior angles .74 mm.; collar 6 mm., dark brown, opaque; punctures concolorous, lateral margins straight, ecarinate; calli slightly convex, confluent with the apical area of disk, polished; disk fulvous, anterior part and posterior half becoming piceous, darkest specimens with only a fulvous spot behind the calli, the slender basal margin remaining pale or ivory-white; propleura yellowish brown, opaque, coxal cleft and just above at anterior angle blackish; xyphus slightly convex in front, receding posteriorly, yellowish to dusky brown. *Scutellum* convex, polished, pale to yellowish, becoming brownish on disk but apparently never very dark. *Sternum* dark brownish, more brownish at the sides and on pleura, basalar plate pale yellowish; ostiolar peritreme white, sometimes tinged with yellowish, finely pilose on the episternum just above.

Hemelytra: width 2.02 mm., black punctate, very few punctures on basal half of embolium; clavus yellowish brown, darker along inner margins and each side of claval vein; corium dark brownish to piceous, more or less pale or clear near the basal angle; embolium pale yellowish translucent, somewhat invaded with piceous near apex. *Cuneus* pale translucent to yellowish on the basal half, dark fusco-brownish on the apical half, punctures chiefly pale. *Membrane* clear or only slightly tinged with yellowish, brachium darkened with brownish along apex of cells.

Legs: pale to yellowish, hind femora with a dark mark on anterior face slightly beyond the middle; claws brownish, arolia bristle-like, translucent, erect and converging slightly apically, protruding slightly forward between the claws.

Fig. 18. *Deraeocoris fulvus*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: dark brownish to piceous, paler on sides of genital segment, shining, pale pubescent; genital claspers (fig. 18) distinctive of the species.

♀. Length 4.8 mm., width 2.22 mm., margin of embolium distinctly arcuated on apical half; head and disk of pronotum fulvous, collum black and shining, geminate mark on basal half of tylus blackish; scutellum pale to fulvous, somewhat fulvous on basal half of clavus; inner apical angles of corium and joining across anal area of membrane, brownish black to piceous, frequently a small spot at middle and base of corium fusco-brownish; cuneus yellowish translucent, more translucent at the lateral margin; ventral parts rather uniformly yellowish brown, infuscated along the vagina exterior; antennae pale to yellowish, segment II, 1.25 mm., slender, slightly thicker at apex, pale pubescent, length of exserted hairs slightly greater than thickness of segment.

Holotype: ♂ August 4, Williams, Arizona (H. H. Knight); Cornell University collection. *Allotype*: taken with the type. *Paratypes*: 2♂ 14♀, taken with the types on white oak *(Quercus sp.)*. ARIZONA,—2♀ Aug. 3, Grand View, Grand Canyon; ♀ Aug. 4, Prescott; ♂ 4♀ July 26, Mt. Lemon, alt. 9,000 ft., Santa Catalina Mts. (H. H. Knight). 9♀ July 27, Huachuca Mts., alt. 9,000 ft. (H. G. Barber).

KEY TO THE SPECIES OF GROUP IV

1. Black, shining, scutellum red, head reddish . . . . . *fulgidus* Van D. p. 149
   Sometimes black but scutellum not red; entirely pale, or grayish testaceous and marked with black 2

2. Membrane clear, dorsum pallid, usually marked with black on the calli, corium sometimes fuscous on the apical half; infuscation on scutellum forming along the median line . . . *schwarzii* Uhler p. 146
   Membrane infuscated or at least fumate, dorsum black, or pallid gray and marked with black; scutellum with infuscation forming on each side of the median line, black specimens may have the median line entirely black 3

3. Femora reddish or reddish brown, not distinctly banded on the apical half; scutellum reddish or reddish brown, becoming dark brown or blackish at each side of the median line; venter strongly reddish, varied with yellowish brown; dorsum with suffused brownish invading the paler parts; middle, base and apex of corium, and apex of embolium infuscated . . . . . *bullatus* n. sp. p. 147
   Femora twice banded on the apical half with reddish or reddish brown; scutellum pale yellowish, blackish spot each side of the pale median line; venter piceous to black on the lower side, narrowly yellowish at base and latero-dorsal margin . . *convexulus* n. sp. p. 148

Deraeocoris schwarzii (Uhler)

1893 *Camptobrochis schwarzii* Uhler, Proc. Ent. Soc. Wash., ii, p. 375.
1909 *Camptobrochis schwarzii* Reuter, Acta Soc. Sci. Fenn., xxxvi, No. 2, p. 58.
1917 *Camptobrochys (Mycterocoris) schwarzii* Van Duzee, Cat. Hemip., p. 355.

Ovate, convex, pale, the head, calli, and corium marked with blackish, the dark color on scutellum forming along the median line.

♂. Length 4.5 mm. *Head*: width 1.03 mm., vertex .52 mm., length .54 mm.; front convex, carina not apparent but vertex is separated by a groove from the black and broadly exposed collum, tylus prominent; pale, spot each side of vertex, transverse marks each side of front and terminating above in a pair of large spots just in front of vertex, for a short space above base of antenna next to inner margin of eye, geminate mark on tylus with spot at base and transversely at apex, dorsal and apical margins of lorae, small spot on genae and juga, blackish. *Rostrum*, length 1.71 mm., scarcely attaining posterior margins of middle coxae, pale to brownish, becoming piceous at apex.

Antennae: segment I, length .37 mm., pale, becoming blackish on the ventral side; II, 1.14 mm., gradually thickened from base toward apex, not attaining the thickness of segment I, pale pubescent, length of exserted hairs exceeding thickness of segment, pale to brownish, becoming fuscous toward apex; IV, missing.

Pronotum: length 1.17 mm., width at base 1.97 mm., anterior angles 1 mm.; collar .72 mm., pale, opaque; disk convex, coarsely, rather irregularly and closely black punctate, lateral margins slenderly carinate, nearly straight, anterior angles rather broad but rounded; calli very slightly convex, black around margins and with marks upon the disk of each, a black arc projecting forward from the latero-anterior angles and with pale invading the disk each side of it; pale to ivory-white, somewhat shining; coxal cleft somewhat darkened above; xyphus nearly flat, margins carinate bordering the coxal cavity, pale. *Scutellum* convex and smooth, pale, becoming brownish along the median line; mesoscutum slightly exposed, brownish black. *Sternum* and pleura pale to dark brownish, episterna becoming blackish first; ostiolar peritreme pale, dorsal margin somewhat invaded by blackish.

Hemelytra: width 2.39 mm., convex, embolar margin slightly arcuate; black punctate but more finely than on pronotal disk, pale but not translucent, spot at middle and somewhat at apex of corium piceous. *Cuneus* pale, opaque, finely black punctate, spot on inner margin at apex fuscous. *Membrane* clear, veins pale fusco-brownish, sometimes slightly invading and staining the membrane each side.

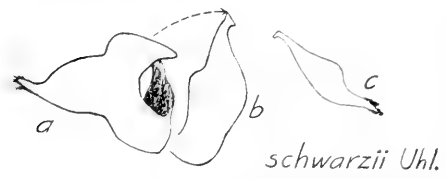

Fig. 19. *Deraeocoris schwarzii*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Legs: pale, coxae with a dark brownish to blackish spot at base; femora biannulate with brownish black on apical half, sometimes with fuscous spots on the basal half; tibiae biannulate with blackish on the basal half; tarsi fuscous at apex, claws brownish.

Venter: dark brownish to piceous, shining, the pale color persisting lat-

erally and near base, a large somewhat rounded piceous spot beneath the spiracle on each side of the first four or five segments but pale just beneath the spots, pale pubescent; genital claspers (fig. 19) distinctive of the species.

♀. Length 4.9 mm., width 2.45 mm., more robust than the male and with the dark marks more reduced; scutellum may be entirely pale or with only a brown streak along the median line, infuscations of corium absent; geminate mark on tylus, anterior margin of lorae, collum, and marks about the margins of calli, blackish; segment II, length 1.17 mm., slender, enlarged toward apex, length of exserted hairs nearly equaling twice the thickness of segment, pale, dark brownish at apex; black markings on the legs usually much reduced.

Lectotype: ♂ June 22, 1891, American Fork, Utah (E. A. Schwarz); Cat. No. 24171 U. S. N. M. *Plesiotype*; ♂, cotype by Uhler; author's collection. *Specimens examined*: 2♂ 3♀ June 22, ♀ June 24, American Fork, Utah (E. A. Schwarz); ♀ July 8, 9, 1882, Yakima river, "Opp. Ellenberg," Washington Territory (Hagen); all cotypes by Uhler. ♂ "Colo. 2020" which has the median line on front obscured by piceous. The specimen taken by Dr. Hagen near the Yakima river is more heavily marked with black than is the case with the females from the type locality.

This species was collected by Mr. Schwarz on desert vegetation near American Fork, and, as the color and other characteristics indicate, it is a form to be expected only in the arid regions of the United States.

Deraeocoris bullatus new species

More convex and darker colored than *schwarzii*, scutellum red, becoming blackish each side of median line, membrane infuscated on the apical half.

♂. Length 4.7 mm. *Head*: 1.03 mm., vertex .51 mm., length .57 mm.; carina slight but apparent, front broadly convex, collum broadly exposed and dark yellowish like the rest of the head; geminate mark and transversely at tip of tylus blackish, juga frequently with reddish. *Rostrum*, length 1.91 mm., reaching upon the hind coxae, dark brownish to piceous.

Antennae: segment I, length .37 mm., dark fusco-brownish; II, 1.2 mm., slender on the basal half, gradually enlarged on the apical half and nearly attaining the thickness of segment I, pale pubescent, exserted hairs slightly exceeding greatest thickness of segment, piceous to black; III, .45 mm.; IV, .34 mm.; last two segments slender, blackish.

Pronotum: length 1.22 mm., width at base 2.08 mm., anterior angles 1.05 mm.; collar .74 mm., yellowish brown, opaque; disk convex, lateral margins distinctly carinate, nearly straight, the anterior angles broadly rounded; disk coarsely black punctate, punctures arranged irregularly in small groups, more sparsely placed across the middle; calli smooth, slightly convex, confluent, delimited behind by coarse punctures, black, the black color projecting forward at the latero-anterior angles; pale to sordid ivory-white, posterior lobes of disk

becoming suffused with piceous, the median line more pale; propleura pale brownish, opaque, paler at margins, more finely punctate than disk; xyphus nearly flat, yellowish to brownish. *Scutellum* convex, smooth, dark reddish to brownish, median line paler, becoming blackish each side at base; mesoscutum scarcely exposed, reddish brown. *Sternum* and pleura brown, opaque; ostiolar peritreme pale, becoming brownish above.

Hemelytra: width 2.51 mm., convex, embolar margin arcuate; black punctate but more finely than on pronotal disk, pale, becoming stained with brownish and fuscous; slender edge of embolium but broadly at apex, apex of corium and spot at middle, piceous. *Cuneus* pale but not translucent, punctures, apical one-third, and narrowly at base, black. *Membrane* transversely pale across middle, brownish to fuscous on apical one-third, brachium and narrowly each side dark fuscous.

Legs: coxae pale, becoming reddish brown on anterior face; femora reddish brown, more translucent basally; tibiae fusco-brownish to blackish, biannulate with pale, frequently a third pale indication at knee; tarsi brownish to blackish, claws brown, distinctly cleft; arolia erect, bristle-like, parallel or slightly divergent apically.

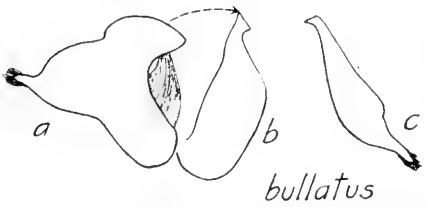

Fig. 20. *Deraeocoris bullatus*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: pale to reddish or reddish brown, becoming piceous on base of genital segment, pale pubescent; genital claspers (fig. 20) distinctive of the species.

♀. Length 4.5 mm., width 2.65 mm., slightly more robust but very similar in color to the male; segment II, length 1.22 mm., slender, slightly enlarged on the apical one-fourth, pale pubescent, exserted hairs equaling greatest thickness of segment, piceous, a dark brownish band just beyond middle.

Holotype: ♂ August 3, Grand View, Grand Canyon, Arizona (H. H. Knight); Cornell University collection. *Allotype*: taken with the type. *Paratypes*: ♂ 4♀ taken with the types on the cliff rose, *Cowania mexicana*, while the shrub was in flower. ♂ 2♀ June 18, Ashfork, Arizona (Barber & Schwarz).

This species doubtless breeds on the cliff rose and was not merely attracted by the flowers as may be the case with some insects. *D. manitou intermedius* bears a close resemblance to *bullatus* but the color of the legs as well as the structure of the claws makes their separation simple.

Deraeocoris convexulus new species

Very similar to *bullatus*, paler above and without red on scutellum and venter, hind femora twice banded on the apical half with reddish brown; left

genital clasper with the dorsal horn longer and the internal arm differently shaped from that of *bullatus*.

♂. Length 4.6 mm. *Head*: width 1.05 mm., vertex .54 mm., length .57 mm.; base of vertex raised into a slight carina, separated by a groove from the arched and broadly exposed collum; pale to yellowish, geminate mark on basal half and slenderly at apex of tylus blackish. *Rostrum*, length 1.88 mm., attaining posterior margins of middle coxae, brownish, becoming piceous on the apical half.

Antennae: segment I, length .38 mm., brownish, darker at apex; II, 1.25 mm., tapering gradually thicker from base toward apex, attaining the thickness of segment I, pale to dusky pubescent, exserted hairs about equaling greatest thickness of segment; III, .51 mm.; IV, .37 mm.; last two segments slender, blackish.

Pronotum: length 1.11 mm., width at base 2.04 mm., anterior angles 1.03 mm., collar .77 mm.; structurally and in color very similar to *bullatus*, the disk and calli slightly more flattened. *Scutellum* convex and smooth, pale, brownish black or piceous each side of median line but scarcely separating the pale at basal angles from that at apex. *Sternum* and pleura yellowish brown, opaque; ostiolar peritreme pale yellowish.

Hemelytra: width 2.57 mm., very similar to *bullatus* but more coarsely punctate; pale, small spot at base, transversely at apex and connected with spot at middle of corium, invading the embolium at apex, blackish. *Cuneus* as in *bullatus*. *Membrane* nearly as in *bullatus* but paler on the apical half, more nearly fumate.

Legs: pale to yellowish; femora biannulate on the apical half with reddish brown; tibiae triannulate with brownish black and with a spot on the knee; tarsi dark brownish, blackish at apex, claws brownish.

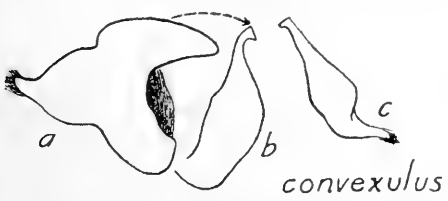

Fig. 21. *Deraeocoris convexulus*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: dark brownish to piceous, paler at the lateral margins and at base, shining, pale pubescent; genital claspers (fig. 21) distinctive of the species.

♀. Length 5.5 mm., width 2.9 mm., very similar to the male but more robust; antennae very similar to those of the female *bullatus*.

Holotype: ♂ May, Los Angeles County, California (Heidemann coll.); Cornell University collection. *Allotype*: same data as the type.

Deraeocoris fulgidus (Van Duzee)

1914 *Camptobrochis fulgidus* Van Duzee, Trans. San Diego Soc. Nat. Hist., ii, p. 21.

1917 *Camptobrochys (Mycterocoris) fulgidus* Van Duzee, Cat. Hemip., p. 355.

Length 5-6 mm. Ovate, convex, shining black, scutellum red, head rufotestaceous.

♂. Length 5 mm. *Head*: width 1.12 mm., vertex .57 mm., length .6 mm.;

carina slight but apparent, front broadly convex, collum broadly exposed; rufotestaceous, tip of tylus and the bucculae becoming black. *Rostrum,* length 2.08 mm., nearly attaining posterior margins of middle coxae, piceous.

Antennae: segment I, length .43 mm.; II, 1.42 mm., slender at base and gradually enlarged to thicker at apex, the greatest thickness just equaling that of segment I, dusky pubescent, exserted hairs equal to one and one-half times the thickness of segment I; III, .52 mm.; IV, .43 mm.; all the segments black.

Pronotum: length 1.4 mm., width at base 2.31 mm., anterior angles 1.12 mm.; collar .85 mm., dark brownish, opaque; lateral margins carinate, nearly straight, anterior angles broadly rounded and slightly reflexed; closely and coarsely punctate, calli convex, confluent, delimited posteriorly by coarse punctures; basal margin of disk sometimes slenderly pale; propleura black, opaque, finely punctate; xyphus nearly flat, dark brownish to black. *Scutellum* rufotestaceous to bright red, convex, smooth and shining. *Sternum* and pleura dark brownish or black, opaque; ostiolar peritreme pale, becoming blackish above and within the ostiole.

Hemelytra: width 2.9 mm., embolar margin strongly arcuated on the apical half, embolium broad; more closely punctate than on the pronotal disk. *Cuneus* nearly triangular, strongly deflexed, sometimes palely translucent near inner angles. *Membrane* brownish black, paler spot bordering tip of cuneus.

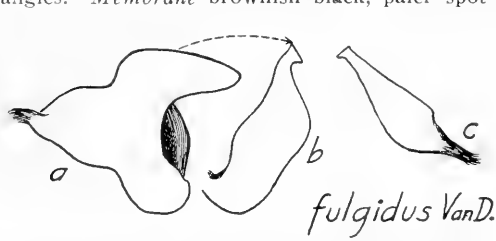

Fig. 22. *Deracocoris fulgidus,* male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: black, shining, pale pubescent; genital claspers (fig. 22) distinctive of the species, in form nearest to *bullatus.*

♀. Length 5.1 mm., width 2.82 mm., very similar to the male in form and coloration; segment II, length 1.34 mm., slender, thickened on the apical one-fourth, scarcely attaining the thickness of segment I, dusky pubescent, exserted hairs equal to twice the thickness of segment.

Plesiotypes: ♂ June 6, ♀ May 4, San Diego County, California (E. P. Van Duzee), paratypes; author's collection. *Specimens examined*: CALIFORNIA,—♀ March 29, 1 ♂ 1♀ May 4, San Diego County, *paratypes* (E. P. Van Duzee). ♀ June 18, Hullville, Lake County (F. E. Blaisdell). ♀, McCloud, Siskiyou County (E. P. Van Duzee). COLORADO,—♂ June 28, Fort Collins (E. P. Van Duzee).

Mr. Van Duzee states that the species lives on Ceonothus.

KEY TO THE SPECIES OF GROUP V

In form of the claws this group shows a close relationship with the species of group II but the impunctate scutellum, genital claspers, general body structure and hairy vestiture of some of the species all point to a closer relationship with the species in groups IV and VI.

1. Dorsum heavily pubescent or hairy, at least with long hairs at anterior angles of the pronotum 12
   Dorsum practically glabrous, at most only sparsely and finely pubescent (not rubbed specimens), rarely with a few hairs at anterior angles of pronotum 2
2. Form broad oval, strongly convex (width greater than or equal to at least one-half the length of the insect) 3
   Form elongate (width not equal to one-half the length) 4
3. Tibiae triannulate with fuscous; disk of pronotum more or less pale, becoming blackish on the basal half and sides; scutellum with black spot each side of the pale median line, but confluent at base; apex of corium and embolium broadly blackish, usually joined by large spot on middle of corium, apical one-third of cuneus black . . . . . *manitou* Van D. p. 153
   Tibiae triannulate with fuscous; disk of pronotum black, narrowly margined with pale; scutellum black, basal angles and tip pale; hemelytra black, basal half of embolium, central portion of clavus, basal half of cuneus, small spot near base of corium, and narrowly bordering basal half of cubitus, irregularly pale, the punctures black . . . . . *manitou intermedius* n. var. p. 154
   Tibiae pale, slightly darker at tips and indistinctly so at middle; dorsum entirely black; head pale, genae, bucculae, margins of lorae, and geminate mark on the tylus, piceous to black . . . . . *manitou atratus* n. var. p. 155
4. Membrane with the apical half heavily infuscated; pronotum and hemelytra usually blackish, in tenerel or pale specimens more or less translucent but darkened with fuscous or brownish 7
   Membrane with the apical half only slightly infuscated, more nearly fumate or brownish; dorsum more pallid, yellowish or reddish than blackish, calli ferruginous or heavily lined with black around the margins and with one or two pale streaks on the disk of each callus . 5
5. Membrane clear, a fumate cloud on the apical half; calli heavily margined with brownish or black, forming a recurved hook at the latero-posterior margins; punctures infuscated, dorsum lurid testaceous with three darker areas on each hemelytron . . . . . *barberi hesperus* n. subsp. p. 159
   Membrane uniformly fumate or brownish; calli without a blackish recurved hook at the latero-posterior margins; punctures mostly pellucid, dorsum pallid to pale yellowish or reddish brown to reddish . 6
6. Calli and pronotum reddish brown to ferruginous; hemelytra yellowish translucid, immaculate; cuneus reddish translucent; scutellum pale . . . . . *rubroclarus* n. sp. p. 156
   Calli margined or lined with black; corium pallid to yellowish, tinged with brown ochre and reddish, opaque except for pellucid punctures; cuneus yellowish, opaque, the apex blackish; scutellum vittate . . . . . *navajo* n. sp. p. 155
7. (4) Antennae (♀) with prominent exserted hairs on segment II, in length equal to three times the thickness of segment at middle; (♂) segment II as thick at the middle as on the apical half, length of ex-

serted hairs equal to one and one-half times the thickness of the segment . . . . . *laricicola* n. sp. p. 164

Antennae (♀) with exserted hairs, in length scarcely equal to twice the thickness of the segment where they occur; (♂) segment II slender on the basal half, distinctly thicker on the apical half than at middle, or if not, then the length of exserted hairs not greater than the thickness of the segment. 8

8. Calli margined or lined with black, rarely entirely black, ivory-white just before and extending inward from the anterior angles in one or two curved lines upon disk of each callus; (♂) segment II of antennae nearly as thick at middle as on the apical half, length of exserted hairs scarcely as great as the thickness of the segment . . . . . *pinicola* n. sp. p. 162

Calli solid black; segment II very similar in both sexes, slender on the basal half and gradually becoming thicker toward the apex, exserted hairs about equal to thickness of the segment 9

9. Tibiae distinctly triannulate with pale; a small subovate form, length 5-5.5 mm. . . . . *mutatus* n. sp. p. 161

Tibiae uniformly dark, or pale on the apical half, sometimes with a pale indication just below knee and obscurely banded with pale on the apical half but never distinctly triannulate; larger forms, length close to 6 mm. 10

10. Scutellum uniformly brownish; hind tibiae broadly pale on apical half but without a pale indication below knee . . . . . *appalachianus* n. sp. p. 160

Scutellum blackish, marked with pale at least on basal angles and at apex; hind tibiae dark, or an obscure pale band on apical half and usually a pale indication just below knee 11

11. Femora paler on the basal half, hind tibiae usually with an obscure pale annulus on the apical half and a pale indication just below knee . . . . . *barberi* n. sp. p. 157

Femora and tibiae uniformly dark brownish black . . . . . *barberi lignipes* n. var. p. 159

12. (1) Legs uniformly dark sepia brown or blackish, hind tibiae frequently with a pale annulus on the apical half 15

Legs not uniformly sepia black, femora more or less pale or the tibiae biannulate with paler 13

13. Legs and general body coloration fusco-grayish to blackish, never reddish brown; hind femora pale on the basal half, two or three linear series of dark spots visible, apical half dark fuscous to blackish but divided by a narrow pale annulation; tibiae biannulate with pale . . . . . *kennicotti* n. sp. p. 166

Legs and usually the body coloration dark reddish brown to blackish; hind femora obscured on the basal half, more or less reddish brown, pale annulation usually apparent on the apical half; tibiae dark reddish to brownish, either bi- or triannulate with pale 14

14. Hemelytra grayish testaceous to brownish, distinctly darker or even piceous on the apical half of the corium; hind tibiae with a distinct

pale annulus on the apical half, two narrow and poorly defined pale annuli on the basal half, the pale band at middle of basal half usually incomplete on the dorsal side . . . *fulvescens* Reuter p. 167

Hemelytra uniformly reddish brown, not darker on the apical half of the corium than on the embolium; hind tibiae triannulate with pale . . . . . *pilosus* n. sp. p. 159

15. Pronotum, hemelytra and legs uniformly dark sepia brown or blackish, the semitranslucent areas stained with brownish; hind tibiae usually distinctly annulated with pale on the apical half . . . . . *nigritulus* n. n. (=|| *nigritus* Reut.) p. 170

Pronotum usually fusco-grayish or black; hemelytra fuscous to black, becoming paler in certain areas but not stained with brownish; legs brownish black, hind tibiae sometimes indistinctly annulated with paler on the apical half; front coxae, xyphus, lower margins of propleura, ostiolar area, gula, sides of tylus, juga and arcuated streak just above on each side of front, pale . . *albigulus* n. sp. p. 171

Deraeocoris manitou (Van Duzee)

1904 †*Mycterocoris cerachates* Uhler, Proc. U. S. Natl. Mus., xxvii, p. 358.
1920 *Camptobrochys manitou* Van Duzee, Proc. Calif. Acad. Sci., ser. 4, ix, p. 355.

Length 4.5-5 mm. Ovate, convex, dorsum glabrous, coarsely punctate; closely related to *bullatus* and *convexulus* but differs in the type of claws; more ovate and robust than *fenestratus;* pale to testaceous and maculated with piceous, callosities and punctures black.

♂. Length 4.5 mm. *Head*: width 1.03 mm., vertex .54 mm., length .71 mm.; front moderately convex, polished, carina feebly developed; collum exposed, black; yellowish and marked with brown and black, front each side of median line transversely marked with six or seven fine brownish to blackish lines; above base of antenna, bordering the front margin of eyes and projecting on vertex, brownish to piceous; slender pair of longitudinal lines on tylus, base of genae, dorsal margins of lorae and bucculae, brownish to piceous, frequently reddish on juga. *Rostrum*, length 1.85 mm., reaching to near hind margins of middle coxae, yellowish brown, basal segment darker, the apical segment piceous.

Antennae: segment I, length .35 mm., yellowish, a brownish line on the dorsal side; II, length 1.14 mm., yellowish to brownish, apical one-fifth infuscated, basal one-third dark brownish on the dorsal side; III, .45 mm., blackish; IV, .40 mm., blackish; finely pale pubescent, length of hairs on segment II equal to little more than the thickness of segment.

Pronotum: length 1.2 mm., width at base 2.05 mm.; anterior angles 1.05 mm., strongly rounded; collar .71 mm., brownish; disk deeply, irregularly, sometimes confluent but not densely punctate, strongly convex, lateral margins slenderly carinate, nearly straight, anterior and basal angles broadly rounded; pale yellowish, discal area each side of middle clouded with piceous; calli black, practically flat, joined at the anterior angles by a piceous arc; very finely and sparsely pubescent at anterior angles; propleura yellowish, becoming reddish

anteriorly, xyphus reddish; margin of coxal cavity anterior to coxal cleft very prominent, flaring, narrow margin white. *Scutellum* impunctate, convex and polished, obscurely transversely wrinkled; whitish, piceous medially at base and extending to cover lateral areas of disk; mesoscutum brownish to piceous, paler at lateral angles. *Sternum* and pleura reddish; ostiolar peritreme white.

Hemelytra: width 2.68 mm., strongly convex, embolium arcuate from base to apex, cuneus and membrane strongly deflexed; coarsely and irregularly punctate, punctures black, surrounded by piceous and frequently confluent; clavus largely pale, piceous at apex and along margins; corium broadly piceous at apex and invading embolium, narrowly piceous at base, a larger patch at middle which is rather broadly joined with the piceous distal area; embolium largely pale, apex, slightly at middle, bordering the marginal vein and the extreme lateral edge, piceous. *Cuneus* pale, the apical one-third piceous, punctures infuscated. *Membrane* fuscous, a paler band bordering apices of areoles, joining at middle and continuing medially between the large areoles, veins piceous.

Legs: femora uniformly piceous, pale at the apices; tibiae pale, triannulate with fuscous or piceous, an oblique band at middle, less distinctly near base and rather broadly but paler at apex; tarsi pale fuscous, slightly darker at apices; clothed with fine inconspicuous pale pubescence.

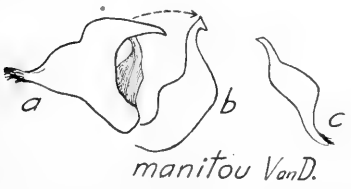

Fig. 23. *Deraeocoris manitou*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: reddish to piceous, polished, finely pale pubescent; genital claspers (fig. 23) distinctive of the species.

♀. Length 5.4 mm., width 3 mm.; larger and more robust than the male but very similar in coloration.

Plesiotype: ♂ July 19, Manitou, Colorado (E. P. Van Duzee); *holotype*, (No. 713) collection of California Academy of Sciences. *Paratypes examined*: COLORADO,—2♀ July 25, Manitou (E. P. Van Duzee); 3♀ July 17, ♀ Aug. 7, Colorado Springs; ♀ July 25, Rifle. NEW MEXICO,—♀ Aug. 1-15, Jemez Springs, alt. 6,400 ft. (Woodgate). *Specimens examined*: ARIZONA,—3♀ June 18, Ashfork (H. S. Barber). NEW MEXICO,—♀ Aug. 10, ♀ Aug. 16, Las Vegas (Barber & Schwarz).

The last two specimens mentioned represent the material which Uhler (1904) had before him when describing the new genus *Mycterocoris* and thus the genus was founded on a misidentification of his own species, *Deraeocoris cerachates*.

Deraeocoris manitou intermedius new variety

Structurally not differing from the typical *manitou* but having a different color aspect; disk of pronotum black, slenderly margined with pale, some-

times slightly paler behind the calli; scutellum black, basal angles and apex pale or ivory-white; hemelytra black, basal half of embolium, central portion of clavus, basal half of cuneus, small spot near base of corium, and narrowly bordering basal half of cubitus, irregularly pale between the black punctures; tibiae triannulate with fuscous.

Holotype: ♂ Aug. 1-15, Jemez Springs, New Mexico (J. Woodgate); author's collection. *Allotype*: same data as the type. *Paratypes*: ♂ July 7, ♀ July 21, ♀ Aug. 1-15, Jemez Springs, New Mexico (J. Woodgate).

Deraeocoris manitou atratus new variety

Apparently not differing structurally from the typical *manitou;* dorsum entirely black; head pale, genae, bucculae, margins of lorae, and geminate mark on tylus, piceous to black; tibiae pale, slightly darker at tips and indistinctly so at middle.

Holotype: ♂ June 17, Jemez Springs, New Mexico (J. Woodgate); author's collection. *Allotype*: same data as the type. *Paratypes*: ♂♀ taken with the types. ARIZONA,—1♂ 1♀ June 17, 2♂ 2♀ June 18, ♀ June 28, Ashfork (H. S. Barber).

It is worthy of note that in this variety the legs are paler than the typical *manitou* while the dorsum has grown entirely black. The development in color seems to run thus: the blacker the dorsum the paler the legs.

Deraeocoris navajo new species

Dorsum pallid to yellowish, tinged with brown ochre and reddish, punctures chiefly pellucid, calli and vittate marks on scutellum blackish, membrane fumate.

♂. Length 5.6 mm. *Head*: width 1.2 mm., vertex .54 mm., length .63 mm.; facial angle less than a right angle, carina poorly defined, the brownish collum moderately exposed, an impressed brownish spot each side of vertex; pale to yellowish, rather indistinct reddish to brownish transverse marks each side of frontal median line; triangular mark at base and geminate mark on basal half of tylus, dorsal margin of lorae, above base of antenna and reaching inner margin of eye, blackish, a reddish spot beneath the rather large brown eyes. *Rostrum,* length 2.51 mm., nearly attaining the posterior margins of hind coxae, brownish to piceous, darker at apex.

Antennae: segment I, length .4 mm., yellowish, becoming infuscated at base and narrow apex; II, 1.63 mm., slender at base and gradually thickened toward apex, exceeding the thickness of segment I, pubescence infuscated, exserted hairs about equaling greatest thickness of segment, yellowish to brown, the apical half black; III, .63 mm.; IV, .44 mm.; last two segments black, finely pale pubescent.

Pronotum: length 1.35 mm., width at base 2.25 mm., anterior angles 1.05 mm.; collar .88 mm., prominent, yellowish and opaque; disk convex, punctures chiefly concolorous or pellucid, becoming infuscated at basal angles, lateral margins distinct, slightly sinuate, anterior angles narrowed but distinct; calli slightly convex, irregularly delimited behind by coarse punctures, separated at median line by a pair of punctures, black, a blackish arc extending forward from the antero-lateral angles; propleura more finely punctate than disk, pale to yellowish, a reddish brown spot at top of coxal cleft; xyphus practically flat, longly but sparsely pale pubescent. *Scutellum* convex, shining, slightly wrinkled on disk, yellowish, a brownish black vitta each side of median line on the apical half; mesoscutum moderately exposed, yellowish brown. *Sternum* and pleura yellowish to brownish, opaque, meta-episterna tinged with reddish; ostiolar peritreme pale, becoming yellowish about the ostiole.

Hemelytra: width 2.77 mm., embolar margin sinuate; pale to yellowish, punctures chiefly pellucid, spot at base and middle of corium, transversely across tip of embolium, corium and clavus, stained with brown ochre and reddish. *Cuneus* pale to yellowish, chiefly opaque, punctures mostly infuscated, apex brownish black, slightly reddish at base. *Membrane* fumate, brachium distinctly reddish, a small fuscous mark lying against the brachium just outside apex of the larger areole.

Legs: pale to yellowish brown, each coxa with a pair of shining fuscous spots at base; femora indistinctly marked with reddish before apices; tibiae triannulate with reddish brown or fuscous, also a spot on the knee; tarsi brownish, infuscated at apices, claws not cleft at base, arolia slender, erect, bristle-like, translucent, nearly parallel or only slightly converging at apices.

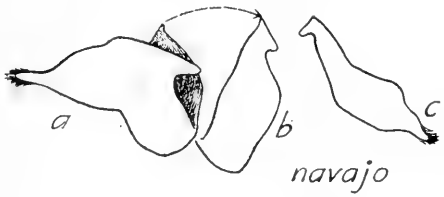

Fig. 24. *Deraeocoris navajo*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: yellowish to reddish, two basal segments more broadly reddish, an impressed, polished piceous spot on each segment beneath the spiracle and separated from it by a space equal to diameter of spot; genital segment piceous, polished, a large yellowish spot each side near apex; genital claspers (fig. 24) distinctive of the species.

Holotype: ♂ August 3, Grand View, Grand Canyon, Arizona (H. H. Knight); Cornell University collection.

This very distinct and interesting species is represented only by the type specimen which was swept from the cliff rose *(Cowania mexicana)*. The failure to secure additional specimens indicates that its presence on that plant may have been accidental.

Deraeocoris rubroclarus new species

Elongate, calli and pronotum reddish brown to ferruginous, scutellum pale; hemelytra yellowish translucid, immaculate, cuneus reddish translucent.

♀. Length 6.3 mm. *Head*: width 1.14 mm., vertex .55 mm., length .71 mm.; tylus more prominent at base than in *navajo*, facial angle a right angle, eye sloping slightly forward, carina obsolete, separated from the broadly exposed collum by a groove, front broadly convex, shining; yellowish red, geminate mark on tylus, spot on juga, spot on genae, and above base of antenna, bright red. *Rostrum*, length 2.31 mm., attaining the posterior margins of the middle coxae, brownish translucent, apex piceous.

Antennae: segment I, length .54 mm., yellowish translucent to brownish; II, 1.77 mm., slender, slightly enlarged on the apical one-fourth, not attaining the thickness of segment I, sparsely pale pubescent, length of exserted hairs about equal to greatest thickness of segment, yellowish, blackish on the thickened apex; III, .71 mm.; IV, .57 mm.; last two segments blackish.

Pronotum: length 1.51 mm., width at base 2.39 mm., anterior angles 1.03 mm., collar .83 mm.; rather finely and closely punctate, punctures concolorous, lateral margins distinct but ecarinate, nearly straight, anterior angles narrowed but distinct, lateral margins of disk sparsely set with pubescent hairs; calli convex, ferruginous, shining, usually slightly darker than the disk; propleura finely punctate, yellowish to brown; xyphus slightly convex anteriorly, depressed posteriorly. *Scutellum* convex, smooth and shining, pale or white, sometimes with a tinge of reddish; mesoscutum slightly exposed, brownish. *Sternum* and pleura yellowish to brownish or reddish, opaque; ostiolar peritreme white.

Hemelytra: width 2.9 mm., embolar margin slightly sinuate, moderately convex, rather closely punctate, punctures concolorous; yellowish translucid, marginal vein at tip of embolium and the inner angles of corium with coagulated red. *Cuneus* reddish translucent, darker red apically, punctures apparent but concolorous. *Membrane* uniformly stained with pale brownish, slightly paler at tip of cuneus, brachium somewhat reddish.

Legs: yellowish with coagulated reddish, sometimes turning brownish; femora obscurely biannulated with reddish on apical half; tibiae rather obscurely triannulate with reddish or brownish, darker on the apical band; tarsi brownish to fuscous, darker at apices, claws and arolia as in *navajo*.

Venter: brownish to bright red, slightly darker on the sides, yellowish pubescent.

Holotype: ♀ August 12, Portland, Oregon (A. A. Nichol); author's collection. *Paratypes*: ♀ Aug. 18, Sannich District, British Columbia (W. Downes). ♀, "W. T." [Washington Territory] (Uhler collection).

Data on the food habits are not available but judging by the habits of other species in the group, *rubroclarus* is most likely to be found by beating coniferous trees in the Vancouveran faunal area.

Deraeocoris barberi new species

Dark brownish to piceous, calli solid black, usually slightly larger than *pinicola;* antennae very similar in both sexes, exserted hairs equal to thickness of the segment.

♂. Length 6.1 mm. *Head*: width 1.2 mm., vertex .54 mm., length .65 mm.; facial angle scarcely equal to a right angle, front broadly convex, carina obsolete, vertex separated by a groove from the black and broadly exposed collum; pale testaceous, front rather broadly, base of tylus, above base of antenna and extending along front margin of eye where it terminates in a spot on vertex, geminate mark on tylus which may be fused in darkest specimens, spot on genae, dorsal margins of bucculae and lorae, more or less on juga and tip of tylus, blackish. *Rostrum*, length 2.62 mm., nearly attaining posterior margins of the hind coxae, dark brownish to piceous.

Antennae: segment I, length .43 mm.; II, 1.51 mm., gradually thickened from base toward apex, almost equaling the thickness of segment I, pale pubescent, length of exserted hairs just equaling thickness of segment; III, .54 mm.; IV, .47 mm.; fusco-brownish to blackish.

Pronotum: length 1.45 mm., width at base 2.31 mm., anterior angles 1.14 mm., collar .81 mm.; moderately convex, coarsely and rather closely punctate, lateral margins slenderly carinate, anterior angles slightly rounded but distinct; calli convex, confluent, black and shining, delimited behind by coarse punctures, a black arc extending forward from the antero-lateral angles to front margin of disk; punctures black, posterior lobes of disk largely fusco-brownish, paler near lateral margins and at anterior angles; propleura more finely punctate, brownish black, paler around the margins; xyphus slightly convex anteriorly, depressed posteriorly, testaceous to fuscous. *Scutellum* moderately convex, smooth and shining, brownish black, basal angles, apex, and median line pale or ivory-white. *Sternum* and pleura brownish black, opaque, a spot at dorsal margin of meso- and one on meta-episterna shining; ostiolar peritreme white, becoming infuscated dorsally.

Hemelytra: width 2.74 mm., embolar margin slightly sinuate, moderately convex, closely and rather coarsely black punctate; fusco-brownish to piceous, embolium paler between the punctures, apical half of corium piceous, becoming more nearly black at middle, extreme apical margin of corium more or less translucent. *Cuneus* fusco-brownish, more translucent on basal half and blackish at apex, punctures black. *Membrane* pale, fusco-brownish on the apical half and produced basally at middle, veins dark fusco-brownish, the areoles darkened apically, a blackish mark lying against the brachium just outside at apex of the larger areole.

Legs: fusco-brownish, basal half of femora paler but with dark points, hind femora darker on apical half but broken by an obscure and interrupted pale band before apex; tibiae dark fusco-brownish, frequently paler at middle of the apical half, sometimes with a pale mark just below the knee but never distinctly triannulate; tarsi dark brownish to blackish, claws brownish translucent; arolia slender, bristle-like, translucent, erect and protruding forward in front of the claws, nearly parallel but diverging somewhat apically.

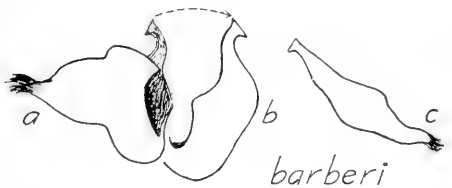

Fig. 25. *Deraeocoris barberi*, male genital claspers. a, left claspers, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: brownish black to piceous, pale pubescent; genital claspers (fig. 25) distinctive of the species.

♀. Length 6.6 mm., width 3.1 mm.; very similar to the male in form and coloration; segment II, length 1.6 mm., slightly more slender than in the male, gradually thickened on the apical half, length of exserted hairs slightly greater than thickness of segment.

Holotype: ♂ August, 1906, Glen Sioux County, Nebraska (H. G. Barber); author's collection. *Allotype*: taken with the type; collection of H. G. Barber. *Paratypes*: ♂ 12♀ taken with the types. ARIZONA,—July 3, Flagstaff (H. S. Barber). ♂ 2♀ July 17, Williams (Barber & Schwarz). COLORADO,—♂♀ July 21, Golden (W. J. Gerhard). ♀ July 23, Pine (C. A. Hill). MONTANA,—2♀ Sept. 11, Bear Paw Mountain (Uhler collection). NEW MEXICO,—♀ Aug. 13, Las Vegas (H. S. Barber).

This species is named in honor of Mr. H. G. Barber who is known for his excellent work on the Heteroptera and particularly the family Lygaeidae. Mr. Barber is not certain of the tree from which the specimens of this species were collected but thinks that it must have been pine.

Deraeocoris barberi lignipes new variety

Not differing structurally from the typical *barberi;* dorsum more uniformly stained with dark brownish; legs uniformly dark brownish black, shining.

Holotype: ♂ July 29, Huachuca Mountains, Arizona (H. G. Barber); author's collection.

Deraeocoris barberi hesperus new subspecies

Structurally very close to if not identical with the typical *barberi,* but differs at least in the general color aspect; calli outlined with piceous and forming a recurved hook at the latero-posterior margins, marked with pale or brown on the disk of each callus; basal half of femora pale, tibiae triannulate with pale, membrane clear, a fumate cloud on the apical half.

♂. Length 5.9 mm. *Head*: width 1.17 mm., vertex .54 mm., length .71 mm.; median line of front and an arc at each side touching the eye pale; broad arc composed of short transverse piceous bars each side of the pale median line and joining above, a piceous spot projecting from each eye upon the vertex. *Rostrum,* length 2.48 mm., reaching to near posterior margins of hind coxae, yellowish to brownish.

Antennae: similar to *barberi,* brownish to piceous, darker toward apex of segment II, segments III and IV blackish.

Pronotum: structurally very similar to *barberi;* testaceous to brownish, front margin and anterior angles largely pale; calli outlined with piceous, forming a recurved hook at the latero-posterior margins, disk irregularly marked with pale or brownish, a piceous line through the middle of each; anterior

angles with a thick piceous line leading to each callus. *Scutellum* piceous, the basal angles, median line and apex, pale. *Sternum* and pleura brownish to piceous; ostiolar peritreme white.

Hemelytra: width 2.65 mm.; testaceous to brownish, somewhat translucid; corium with whitish spot near base, a larger similar spot on the apical half but more or less divided by fusco-piceous; narrowly at base, between pale spots and more broadly at apex of corium, fusco-piceous. *Cuneus* testaceous, translucid, apex dark brownish to piceous, inner margin next to base of smaller areole pale. *Membrane* clear, fumate cloud on apical half, veins and slightly invading the membrane, dark brownish.

Legs: basal half of femora pale, apical half with two fusco-brownish or reddish brown annulations; tibiae triannulate with pale and with fusco-brownish; tarsi brownish to piceous.

Venter: brownish to piceous, shining; genital claspers are not appreciably different from the typical *barberi* (fig. 25).

Holotype: ♂ August 24, 1916, Summit, alt. 7,000 ft., Placer Co., California (W. M. Giffard); collection of California Academy of Sciences. *Allotype*: same data as the type. *Paratypes*: CALIFORNIA, —2♀, topotypic. ♀ July 24, Huntington Lake (E. P. Van Duzee). 1♂ 2♀ Aug.-Sept., Placer County.

Deraeocoris appalachianus new species

Closely related to *barberi*, general aspect more suggestive of a pale *nigritulus* but differs in the glabrous dorsum and short hairs on tibiae; scutellum uniformly brownish, less convex than in *barberi;* tibiae reddish brown, broadly pale on the apical half.

♀. Length 6.2 mm. *Head*: width 1.17 mm., vertex .57 mm., length .68 mm.; facial angle a right angle, outline of tylus more rounded and the head less pointed than in *barberi;* marked similarly to *barberi* but the black color replaced with brownish black. *Rostrum*, length 2.48 mm., attaining middle of the hind coxae, dark brownish, basal segment piceous.

Antennae: segment I, length .51 mm., fusco-brownish; II, 1.57 mm., slender, thickened on the apical one-fourth but not attaining the thickness of segment I, length of exserted hairs equal to twice thickness of segment at middle, fusco-brownish, darker at apex; III, .68 mm.; IV, .54 mm.; last two segments brownish to black.

Pronotum: length 1.34 mm., width at base 2.34 mm., anterior angles 1.14 mm., collar .83 mm.; disk more closely and uniformly punctured than in *barberi,* rather uniformly dark fusco-brownish, calli and anterior margin of disk brownish black; propleura dark brownish, paler at lower margins; xyphus nearly flat, testaceous, pale pubescent. *Scutellum* more flattened than in *barberi,* smooth and shining, minutely rugulose across the middle, uniformly dark brownish. *Sternum* and pleura dark brownish; ostiolar peritreme darkened with brownish.

Hemelytra: width 2.88 mm., embolar margin slightly more arcuate than in *barberi;* fusco-brownish, clavus and base of corium more yellowish and semitranslucent, embolium paler and semitranslucent, punctures brownish to fus-

cous. *Cuneus* dark brownish, slightly paler at middle, punctures dark brown. *Membrane* fusco-brownish, paler each side opposite tip of cuneus, membrane extending beyond tip of cuneus for a space about equal to length of cuneus.

Legs: fusco-brownish or reddish brown, tips of coxae and basal half of femora paler, apical half of femora without pale indications; tibiae dark brown or reddish brown, apical half broadly pale, hind tibiae slightly curved, length of longest hairs scarcely equal to thickness of segment; tarsi fusco-brownish, claws and arolia very similar to those of *barberi*.

Venter: dark brownish to piceous, shining, pale pubescent.

Holotype: ♀ May 21, (at light) Tryon, North Carolina (W. F. Fiske); author's collection.

This species is most closely allied to *barberi* and related forms, all of which are western in distribution. We may, therefore, regard *appalachianus* as another link in the list of known species which indicate a relationship between the fauna of the southern Appalachian region and the mountain faunas of the western United States.

Deraeocoris mutatus new species

In form and coloration very suggestive of a small specimen of *barberi* but more ovate; tibiae triannulate with pale, left genital clasper with a well-developed dorsal horn.

Length 5.3 mm. *Head*: width 1.12 mm., vertex .51 mm., length .56 mm.; similar to *barberi* but more broadly black, front and vertex solid black, leaving only the basal margin of head at each side of middle, and a slender lunate mark arising at base of tylus and curving up near front margin of eye, pale. *Rostrum*, length 2.31 mm., nearly attaining posterior margins of hind coxae, brownish to piceous.

Antennae: segment I, length .31 mm.; II, 1.2 mm., gradually enlarged from base toward apex, attaining the thickness of segment I, dusky pubescent, length of exserted hairs about equal to greatest thickness of segment; III, .48 mm.; IV, .43 mm.; all the segments brownish black.

Pronotum: length 1.2 mm., width at base 1.97 mm., anterior angles 1 mm., collar .77 mm.; disk moderately convex, lateral margins sinuate, slenderly carinate on the basal half, anterior angles narrowed; calli convex, black, a black mark from the antero-lateral angles lying in a depression adjoining anterior angles of disk; posterior half of disk brownish to piceous, the slender basal margin pale; propleura and xyphus nearly as in *barberi*. *Scutellum* moderately convex, smooth and shining, black, basal angles and apex pale to ivory-white, the median line not indicated. *Sternum* and pleura similar to those of *barberi*.

Hemelytra: width 2.48 mm., embolar margin slightly arcuate; paler than in *barberi*, apical half of corium darkened, more distinctly piceous on a spot at the middle. *Cuneus* comparatively large, length of outer margin greater than the distance from tip of cuneus to apex of membrane; black punctate, somewhat translucent, blackish at apex. *Membrane* infuscated as in *barberi* but in length more abbreviated.

Legs: dark fusco-brownish, trochanters and tips of coxae paler; femora obscurely biannulate with pale at the apices, the band somewhat removed from apex, is interrupted on the anterior face; tibiae triannulate with pale, the basal band just below knee narrow while the band on apical half is comparatively broad; tarsi dark brownish to blackish, claws yellowish translucent, structure of claws and arolia similar to those in *barberi*.

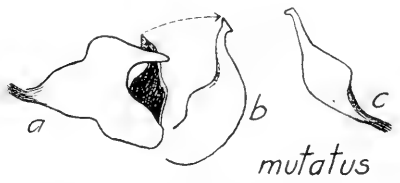

Fig. 26. *Deraeocoris mutatus*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: brownish black, shining, pale pubescent; genital claspers (fig. 26) distinctive of the species.

Holotype: ♂ August 22, Tallac, Eldorado County, California (W. M. Giffard); collection of California Academy of Sciences.

Deraeocoris pinicola new species

Closely related to *barberi* but differs in the antennae and genital claspers and usually is smaller in size; median line of front and just before the calli, pale to ivory-white, antero-lateral angles of calli invaded with pale; general coloration pale to grayish and darkened with blackish, not at all tinged with brownish.

♂. Length 5.7 mm. *Head*: width 1.08 mm., vertex .53 mm., length .57 mm.; carina obsolete, collum broadly exposed, black and shining, separated from the vertex by a groove; pale to ivory-white, front with a black arc each side of median line, broken into transverse bars in pale specimens; bordering front margin of eyes and terminating in a projection on vertex, base and apex of tylus with two connecting longitudinal lines, stripe from lower margin of eye across gena and upon the buccula, apically on lorae, and frequently a spot on juga, black, eyes dark brown. *Rostrum*, length 2.34 mm., reaching to near apices of hind coxae, piceous, paler at the joints.

Antennae: segment I, length .42 mm.; II, 1.51 mm., slender on basal one-fourth, practically cylindrical on the apical half and equal to segment I in thickness, dusky pubescent, length of exserted hairs about equaling thickness of segment; III, .6 mm.; IV, .5 mm.; all the segments black, shining.

Pronotum: length 1.34 mm., width at base 2.19 mm., anterior angles 1 mm.; collar .74 mm., fusco-grayish, opaque; disk moderately convex, coarsely black punctate but more closely and less deeply on the posterior half, lateral margins slenderly carinate, nearly straight, anterior angles rounded but distinct; calli convex, partially separated by a pair of punctures, black and shining but invariably invaded by pale at the latero-anterior angles where a black arc extends to front margin of disk, pale to ivory-white just before; posterior lobes of disk becoming darkened with piceous and black, slender basal margin pale; propleura black punctate, black and opaque surrounding the dorsal half of coxal cleft, margins more or less pale; xyphus nearly flat, infuscated on disk, anteriorly and the carinate lateral margins pale. *Scutellum* moderately convex, smooth and shining, black, basal angles, apex and median line more or less,

pale to ivory-white. *Sternum* and pleura black, opaque, a spot at dorsal margin of meso- and the meta-episterna shining; ostiolar peritreme white, becoming blackish above.

Hemelytra: width 2.68 mm., embolar margin moderately arcuate, slightly sinuate on the basal half; moderately convex, rather coarsely black punctate; pale to fuscous and black, more nearly black on apical half of corium and embolium, slenderly white along the cubitus near base. *Cuneus* moderately deflected, black, more or less pale on basal half, punctures black. *Membrane* rather heavily infuscated, a pale spot bordering tip of cuneus, basal half of areoles frequently somewhat paler, brachium and slightly invading the membrane more heavily infuscated.

Legs: black, tips of coxae and the trochanters paler; hind femora more or less pale on dorsal face of the basal half, an obscure pale mark on dorsal face just before apex; tibiae obscurely biannulate with pale; tarsi blackish, claws very slightly cleft (fig. 2, B) but should not be confused with the type which is deeply cleft near base; arolia slender, erect, bristle-like, translucent, nearly parallel but slightly converging at the very tips.

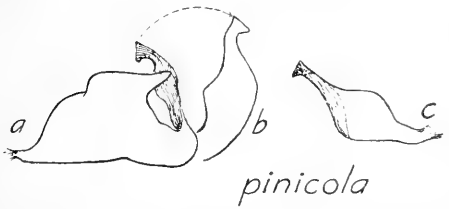

Fig. 27. *Deraeocoris pinicola*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: black and shining, pale pubescent; genital claspers (fig. 27) distinctive of the species.

♀. Length 5.9 mm., width 2.9 mm., very similar to the male but paler in color; the black arc each side of front broken into transverse bars; segment II, length 1.6 mm., slender, thickened on the apical one-fourth, scarcely attaining the thickness of segment I, dusky pubescent, length of exserted hairs only slightly greater than thickness of segment, black as in the male; scutellum more broadly pale, the dark color frequently appearing as a black vitta from base each side of median line; femora more distinctly banded with pale before the apex, tibiae distinctly biannulate with pale; venter chiefly pale, a lateral row of spots, vagina exterior, and more or less on the ventral and anterior margins of segments, black.

Holotype: ♂ June 30, Ithaca, New York (H. H. Knight); author's collection. *Allotype*: same data as the type. *Paratypes*: CONNECTICUT,—♂ June 16, New Haven; ♀ July 22, Hartford (M. P. Zappe). ♀ July 11, New Haven (W. E. Britton). DISTRICT OF COLUMBIA,—♀ June 10, Rock Creek (O. Heidemann). MASSACHUSETTS,—3♀ July 18, Beach Bluff (H. M. Parshley). ♂ July 3, Danvers (C. W. Johnson). ♂ June 20, Natick (C. A. Frost). MINNESOTA,—3♀ Aug. 18, Elkhorn Creek, Carlton Co. (H. H. Knight), on *Pinus strobus*. NEW HAMPSHIRE,—1♂ 1♀ Mount Washington (Mrs. A. T. Slosson). ♀, Pike, "feeding on *Chermes*" [no authority]. NEW YORK,—♂ June 9, ♂ 2♀ June 13, 7♂ 18♀ June 14, 2♀

June 22, 2♂ 3♀ June 27, 2♂ 2♀ June 30, ♂ July 8, Ithaca; 6♂ 2♀ June 26, 12♂ 38♀ July 13, Ringwood near Ithaca (H. H. Knight), all taken on *Pinus strobus*. 1♂ 1♀ July 22, Conifer (H. Osborn). ♂ June 18, 2♂ 5♀ July 8, Cranberry Lake; 2♀ Aug. 1-7, Wanakena (C. J. Drake). 2♀ July 3, Wyandanch, Long Island (Wm. T. Davis). CANADA,—♀ "Milton, Can." [? Ontario] (Uhler collection).

The writer has found this species only on white pine, *Pinus strobus*, to which tree it appears to be restricted in its breeding habits. At Ithaca, on June 9, the fifth stage nymphs were found in numbers on two white pine trees. The nymphs were living among and were predaceous upon the pine bark aphid (*Chermes pinicorticis* Fitch), the predator being covered with a coat of white, wax-like, flocculent material, very similar to that which covered the aphids. On June 13, 1914, the adults were emerging rapidly and the next day most of them were out but many still in a tenerel condition. Most of the adults disappear before the last week in July, the females probably depositing their eggs in the terminal growth, there to spend the winter and hatch the following May.

Deraeocoris laricicola new species

Very suggestive of *pinicola* but slightly larger and more elongate, differs in the prominent exserted hairs on antennae and in the structure of the genital claspers.

♂. Length 6.4 mm. *Head*: width 1.11 mm., vertex .48 mm, length .6 mm.; carina obsolete but the vertex slightly impressed; marked very similarly to *pinicola* but the black arc each side of median line rarely connects with the black at base of tylus, the eyes also being slightly larger and more prominent. *Rostrum*, length 2.22 mm., scarcely attaining the posterior margins of the middle coxae, piceous, paler at the joints.

Antennae: segment I, length .51 mm.; II, 1.77 mm., nearly cylindrical but slightly tapering at base, equal in thickness to segment I, pale to dusky pubescent, exserted hairs prominent, in length equal to one and one-half times thickness of segment; III, .69 mm.; IV, .57 mm.; black, more or less shining.

Pronotum: length 1.42 mm., width at base 2.28 mm., anterior angles 1 mm.; collar .75 mm., opaque, brownish to black; disk moderately convex, coarsely black punctate, more deeply and irregularly behind the calli and at the sides; lateral margins irregularly defined, delimited by coarse punctures, a few pubescent hairs scattered along the margins, anterior angles narrowed, little wider than the collar; calli convex, confluent, black and shining, delimited behind by coarse punctures, the black color extending to front margin of disk except for a small spot before the lateral angles and one between at the median line; disk becoming piceous or black between the punctures, usually paler along the median line and behind lateral margins of calli; propleura more or less pale, black surrounding dorsal half of coxal cleft, opaque, black punctate but more

coarsely near the dorsal margin; xyphus nearly flat, infuscated on the disk, pale pubescent. *Scutellum* moderately convex, shining, impunctate but transversely rugulose on basal half, minutely pubescent, black, basal angles and apex pale to ivory-white, apical half of median line frequently pale; mesoscutum moderately exposed, black, minutely pubescent. *Sternum* black, opaque, median line and spot at base of middle coxae pale; pleura black, margins of sclerites more or less pale, opaque except for spot at dorsal margin of meso- and meta-episterna; ostiolar peritreme white, slightly infuscated at dorsal margin.

Hemelytra: width 2.74 mm., elongate, embolar margins nearly parallel, moderately convex; background pale translucent, coarsely and irregularly black punctate, corium with spot at base, middle, and irregularly across apex, outer edge and tip of embolium, black. *Cuneus* rather elongate, moderately deflexed, pale, black punctate, the apical half black. *Membrane* distinctly elongated, strongly infuscated, spot at tip of cuneus and extending more or less to the middle, within the areoles except at margins, pale; veins more heavily infuscated, the dark color invading the membrane somewhat on each side.

Legs: fuscous to blackish, tips of coxae and the trochanters paler; basal half of hind femora more or less pale, two or three rows of fuscous points persisting on the anterior face; tibiae biannulate with pale, frequently obscured with reddish or brownish; claws not at all cleft, dusky translucent, arolia similar to those of *pinicola*.

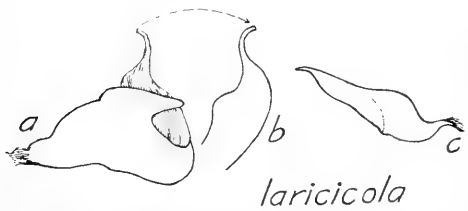

Fig. 28. *Deraeocoris laricicola*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: black, shining, clothed with prominent pale pubescence; in paler forms flecked with reddish, the genital segment, more or less at base and a row of spots on sides, black; genital claspers (fig. 28) distinctive of the species.

♀. Length 6.1 mm., width 2.85 mm.; very similar to the male in coloration but in form less elongate; segment II, length 1.74 mm., moderately slender, thickened on the apical one-fourth but scarcely attaining the thickness of segment I, exserted hairs very prominent, length of those on basal half equal to three times the thickness of segment at middle, pubescence restricted chiefly to the enlarged apical one-fourth; III, .71 mm.; IV, .57 mm., all the segments black; venter brownish to black, in paler forms the black color develops first as a lateral line below the spiracles, on the genital segments and vagina exterior, the paler parts tinged with reddish.

Holotype: ♂ June 27, Ithaca, New York (H. H. Knight); author's collection. *Allotype*: taken with the type. Paratypes: 26♂ 29♀ taken with the types on *Larix laricina*, from the trees which grow on the north slope of the water reservoir on the Cornell University campus. MINNESOTA,—♂ July, 1914, Lake Itasca (S. A. Graham). NEW YORK,—♂ June 23, 2♂ July 1, 2♀ July 7, 1♂ 5♀ July 14, Batavia; ♂ June 16, ♂ June 28, 6♂ 6♀ July 2, Ithaca (H. H. Knight).

The writer has found this species only on *Larix laricina* to which tree the species is probably restricted in its breeding habits. The nymphs are dark colored, clothed with numerous bristles, but not coated with the white, wax-like material as is the case with the nymphs of *pinicola*. Fifth-stage nymphs were reared to the adult stage in cages, both nymphs and adults sucking sap from the tender larch shoots. The species may be predaceous to a certain extent but this point was not determined. It is interesting to note that the closely related but larger European species, *D. annulipes* H. S., lives on larch *(L. decidua)* also. Duda (1885), in some detailed observations on *D. annulipes* H. S. in Bohemia, states that the nymphs fed on aphids which were abundant on larch trees.

Deraeocoris kennicotti new species

Very much resembling and closely related to *laricicola* but having the dorsum distinctly hairy; structure of the male genital claspers very distinctive.

♂. Length (from collar to tip of membrane) 6.7 mm. *Head*: (missing in the only available male). ♀. Width 1.06 mm., vertex .5 mm., length .65 mm.; front and lower part of face closely and rather longly pubescent, tylus more prominent than in *laricicola;* vertex ecarinate, collum broadly exposed, black and shining, separated from vertex by a groove; testaceous, bordering inner margin of eye and projecting upon vertex, an arc each side of front composed of transverse bars but not attaining base of tylus, spot at base and geminate mark on basal half of tylus, juga, lorae, genae and bucculae, black. *Rostrum*, length 2.07 mm., nearly attaining hind margins of middle coxae, dark brownish to piceous, basal segment except narrow tip black.

Antennae: (♀) segment I, length .45 mm., testaceous, becoming black on basal half; II, 1.58 mm., moderately slender, becoming thickened on apical one-fourth but not attaining the thickness of segment I, rather closely beset with exserted hairs which in length are equal to twice thickness of segment at middle, testaceous, apical one-fourth blackish; III, .6 mm.; IV, .54 mm.; last two segments brownish to blackish.

Pronotum: length 1.34 mm., width at base 2.14 mm., anterior angles .8 mm., collar .63 mm.; disk moderately convex, punctures moderately coarse and rather closely set, distinctly hairy, longest near lateral and anterior margins; lateral margins fairly distinct, nearly straight, anterior angles narrowed to little wider than collar; calli moderately convex, irregularly delimited behind by coarse punctures, separated at basal margin by a pair of deep punctures, black, shining, pale between and just before, black color extending from latero-anterior angles to front margin of disk; disk grayish testaceous, punctures black, dark color working out from the punctures; propleura testaceous, black and opaque surrounding dorsal half of coxal cleft, punctures grouped chiefly on the dorsal half; xyphus nearly flat, pale pubescent, disk infuscated. *Scutellum* convex, transversely rugulose on basal half, longly pubescent or hairy, black, basal angles and apex pale, median line slightly indicated near apex. *Sternum*

and pleura black, opaque except for spot at dorsal margin of meso- and metaepisterna; ostiolar peritreme pale, invaded by fuscous at dorsal margin.

Hemelytra: width 2.8 mm., elongate, embolar margins nearly parallel; moderately convex, rather closely and uniformly black punctate, longly pubescent or hairy; background pale testaceous, translucent, dark color spreading from the punctures, spot at base, middle and more or less broadly at apex of corium, narrow edge and tip of embolium, apex of clavus, dark fuscous to blackish. *Cuneus* elongate, brownish black on apical half, paler and black punctate basally. *Membrane* infuscated, paler within the areoles and a spot bordering tip of cuneus which extends transversely more or less toward middle, veins dark fuscous.

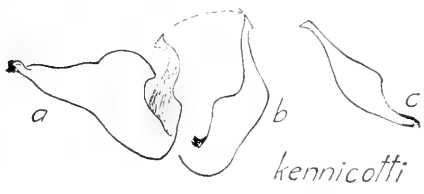

Fig. 29. *Deraeocoris kennicotti*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Legs: fuscous to blackish, trochanters and tips of coxae paler; hind femora pale on basal half except for two or three rows of fuscous points, an obscure pale annulus on the apical half; tibiae biannulate with pale; tarsi blackish, structure of claws and arolia similar to those in *laricicola*.

Venter: dark brownish black, heavily pubescent; genital claspers (fig. 29) distinctive of the species.

♀. Length 5.7 mm., width 2.75 mm.; more robust and the hemelytra shorter but in coloration very similar to the male (head and antennae described above).

♂. *Holotype*: "Great Slave Lake" [Canada] (Robert Kennicott); Uhler collection; Cat. No. 24175 U. S. N. M. *Allotype*: August 21, Mount Katahdin (alt. 5,300 ft.), Maine (C. P. Alexander); author's collection. *Paratype*: ♀, taken with the allotype.

This species is named in honor of Robert Kennicott, one of the pioneer collectors in northwestern America. The female is described from material collected on Mount Katahdin and thus widely isolated from the type locality but the specimens agree so closely, and the characters are so distinctive, there seems to be little doubt regarding their identity.

Deraeocoris fulvescens (Reuter)

1909 *Camptobrochis (Euarmosus) fulvescens* Reuter, Acta Soc. Sci. Fenn., xxxvi, No. 2, p. 56.

1917 *Camptobrochys (Euarmosus) fulvescens* Van Duzee, Cat. Hemip., p. 365.

Grayish testaceous to brownish, hemelytra semitranslucent, apical half of corium becoming piceous; dorsum pilose, lateral and anterior margins of pronotum distinctly hairy.

♂. Length 5.3 mm. *Head*: width 1.05 mm., vertex .51 mm., length .6 mm.; shape of head nearest to *barberi*, facial angle less than a right angle; carina obsolete, collum broadly exposed, black and shining, separated from

vertex by a groove; front broadly convex, shining, finely pilose; pale to testaceous and brownish, bordering front margin of eye, transverse bars each side of front and fusing below in a spot at base of tylus, slender apex and geminate mark on tylus, juga, dorsal margin of lorae, spot beneath eye and more or less at base of bucculae, black or brownish black. *Rostrum*, length 2.37 mm., reaching upon middle of hind coxae, brownish, becoming piceous at base and apex.

Antennae: segment I, length .35 mm., brownish; II, 1.28 mm., tapering gradually larger from base toward apex but scarcely attaining the thickness of segment I, yellowish to brownish, darker on the apical one-fourth, pale pubescent, length of exserted hairs equal to twice greatest thickness of segment; III, .54 mm.; IV, .45 mm.; last two segments brownish to fuscous.

Pronotum: length 1.25 mm., width at base 1.54 mm., anterior angles 1 mm., collar .74 mm.; disk moderately convex, coarsely black punctate, lateral margins distinct, slightly sinuate, anterior angles slightly rounded; calli moderately convex, separated at basal margin by a pair of deep punctures, dark brownish to black, basal margin with a projecting spot at lateral angle, a black arc extending from antero-lateral angle to front margin of disk; disk grayish testaceous and darkened with brownish, shining, pale just before the calli; propleura testaceous, finely black punctate, black just above and in front of coxal cleft; xyphus slightly convex, infuscated, longly pale pubescent. *Scutellum* convex, shining, sometimes transversely rugulose on basal half, clothed with long pilose hairs, brownish black, basal angles and apex pale or ivory-white, the median line sometimes palely indicated on apical half. *Sternum* and pleura dark brownish to blackish, pleural sclerites usually more or less pale around the margins; ostiolar peritreme white, sometimes becoming yellowish.

Hemelytra: width 2.48 mm., embolar margin slightly arcuate; moderately convex, clothed with erect pilose hairs, yellowish brown, somewhat translucent, punctures black, apical half of corium becoming piceous in well-matured specimens. *Cuneus* yellowish translucent, punctures infuscated, apical half dark brownish to blackish. *Membrane* pale to fumate, apical half, veins, and more or less invading membrane each side, infuscated.

Legs: thickly clothed with prominent erect hairs, reddish brown, tips of coxae, trochanters, and bases of femora paler; hind femora with a pale band before apex but usually incomplete on lower side; tibiae with a distinct pale annulus on apical half, two narrow and poorly defined pale annuli on the basal half, the pale band at middle of basal half usually incomplete on the dorsal side, the dark color usually distinctly reddish; tarsi brownish black, claws simple; arolia bristle-like, translucent, erect, inclined slightly forward, nearly parallel but converging slightly at tips.

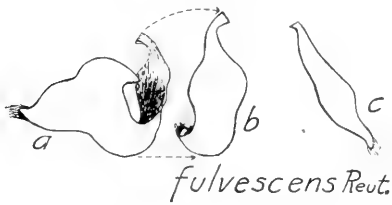

Fig. 30. *Deraeocoris fulvescens*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: dark reddish brown to blackish, shining, longly pale pubescent; genital claspers (fig. 30) distinctive of the species.

♀. Length 5.2 mm., width 2.4 mm., very similar to the male in form and color; segment II, length 1.34 mm., slender, enlarged slightly at apex, rather

sparsely beset with long erect hairs which in length are equal to three times the greatest thickness of segment, yellowish to brownish, slightly darker at apex; venter testaceous to reddish or dark brown, a row of impressed black spots, each side on the lateral submargin.

Allotype: ♂ July 24, 1900, Salida, Colorado; type material; author's collection. *Specimens examined*: ARIZONA,—♂ Aug. 3, Grand View, Grand Canyon (H. H. Knight). COLORADO,—2♂ 4♀ July 24, 1900, Salida; specimens collected with the type. NEW MEXICO,—♂ Aug. 3, ♂ Aug. 5, Las Vegas (Barber & Schwarz).

This species should be looked for upon pines in the Rocky Mountain region.

Deraeocoris pilosus new species

Very similar and closely related to *fulvescens*, but slightly larger and more uniformly colored; hemelytra uniformly reddish brown, not darker on the apical half of corium than on the embolium, tibiae triannulate with pale.

♂. Length 6.2 mm. *Head*: width 1.11 mm., vertex .52 mm., length .63 mm.; front and tylus more broadly blackish than in *fulvescens*. *Rostrum*, length 2.57 mm., nearly attaining posterior margins of hind coxae, brownish to piceous.

Antennae: segment I, length .37 mm., fusco-brownish; II, 1.4 mm., tapering from slender at base to thicker, the apical one-third equaling segment I in thickness, pale pubescent, length of exserted hairs equal to twice the thickness of segment, fusco-brownish, slightly darker at apex; III, .54 mm.; IV, .48 mm.; last two segments blackish.

Pronotum: length 1.34 mm., width at base 2.28 mm., anterior angles 1.08 mm.; collar .85 mm., brownish black, opaque; disk more closely punctate than in *fulvescens*, distinctly hairy; calli brownish black, the disk of each callus invariably paler than at the margins. *Scutellum* more flattened than in *fulvescens*, longly pilose, brownish black, basal angles and apex pale. *Sternum* and pleura brownish black; ostiolar peritreme largely infuscated or brownish.

Hemelytra: width 2.62 mm.; uniformly reddish brown, semitranslucent, rather closely and uniformly black punctate, clothed with prominent erect pilose hairs, apical half of corium never piceous as in *fulvescens*. *Cuneus* colored similarly to the corium, frequently more reddish on the apical half. *Membrane* uniformly pale fuscous or brownish, a slightly paler spot near tip of cuneus, veins frequently reddish brown.

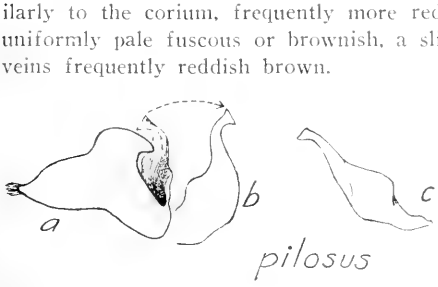

Fig. 31. *Deraeocoris pilosus*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Legs: reddish brown, marked with pale very similarly to *fulvescens* but the tibiae distinctly triannulate with pale.

Venter: dark reddish brown to piceous, shining, longly pale pubescent; genital claspers (fig. 31) indicate a close relationship with *fulvescens* but the right clasper and the internal arm of the left, exhibit specific differences.

♀. Length 5.8 mm., width 2.8 mm., very similar to the male in color but in form less elongate; segment II, length 1.37 mm., slender, enlarged slightly at apex, beset with prominent exserted hairs as in *fulvescens*, brownish, infuscated on the thickened apex.

Holotype: ♂ July 26, Mt. Lemon, alt. 9,000 ft., Santa Catalina Mts., Arizona (H. H. Knight); Cornell University collection. *Allotype*: taken with the type. *Paratypes*: ARIZONA,—4♂ 6♀ taken with the types on pine at the top of Mt. Lemon. 6♂ 10♀ July 29, Huachuca Mts., alt. 9,000 ft. (H. G. Barber).

The writer took specimens by beating a long-leaved pine, *Pinus arizonica*.

Deraeocoris nigritulus new name

1909 *Camptobrochis (Euarmosus) nigrita* Reuter, Acta Soc. Sci. Fenn., xxxvi, No. 2, p. 55. (name preoccupied)

1917 *Camptobrochys (Euarmosus) nigritus* Van Duzee, Cat. Hemip., p. 355.

Subovate, hemelytra only slightly convex, dorsum distinctly hairy, legs thickly clothed with long erect hairs; dark sepia brown to blackish, the subtranslucent parts stained with brownish.

♂. Length 5.9 mm. *Head*: width 1.14 mm., vertex .57 mm., length .68 mm.; front broad, moderately convex, carina very slight or not apparent, collum broadly exposed, separated from vertex by a groove; heavily pubescent, dark brownish black, tylus frequently paler and exhibiting two dark vittae, narrow basal margin of vertex and spot on juga frequently pale. *Rostrum*, length 2.28 mm., reaching slightly beyond hind margins of middle coxae, brownish black.

Antennae: segment I, length .51 mm.; II, 1.71 mm., slender, slightly enlarged on the apical one-fourth but not attaining thickness of segment I, dusky pubescent, length of exserted hairs equal to three times thickness of segment; III, .65 mm.; IV, .54 mm.; all the segments brownish black.

Pronotum: length 1.4 mm., width at base 2.42 mm., anterior angles 1.03 mm., collar .85 mm.; disk moderately convex, coarsely but rather uniformly punctate, distinctly hairy, lateral margins carinate, anterior angles distinct; calli convex, confluent, more blackish than pronotal disk; propleura more finely punctate than disk, lower margins slightly paler; xyphus nearly flat, testaceous to brownish. *Scutellum* moderately convex, smooth and shining, pilose, brownish black. *Sternum* and pleura dark brownish black, dull except for the small spots at dorsal margins of the episterna; ostiolar peritreme pale brownish to blackish.

Hemelytra: width 2.9 mm., embolar margin moderately arcuate; slightly convex, clothed with long brownish pilose hairs, rather coarsely and closely black punctate; sepia brown to blackish, embolium semitranslucent but stained with brownish. *Cuneus* uniformly colored like the corium. *Membrane* and veins fusco-brownish, slightly paler immediately distad of the areoles and opposite tip of cuneus.

Legs: dark brownish to blackish, shining, tips of coxae, trochanters, and bases of femora paler; tibiae rather broadly but sometimes obscurely annulated with paler on the apical half, rather thickly beset with prominent erect hairs which in length exceed thickness of tibia; tarsi fusco-brownish, claws with a slight indication of a notch (fig. 2, C); arolia slender, bristle-like, erect, directed slightly forward, converging at the apices.

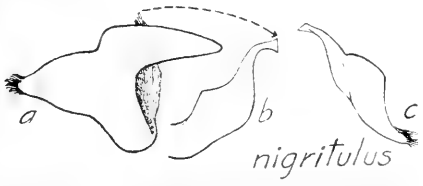

Fig. 32. *Deraeocoris nigritulus*, male genital claspers. a, left clasper, lateral aspect: b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: brownish black, shining, clothed with prominent brownish pubescence; genital claspers (fig. 32) distinctive of the species.

♀. Length 6.4 mm., width 3.1 mm.; very similar to the male in form and color; segment II, length 1.85 mm., slender, very slightly thickened at apex, beset with exserted hairs which in length are equal to three times thickness of segment, fusco-brownish, darker at apex.

Lectotype: ♂ June 25, 1895 (!), Washington, D. C. (O. Heidemann); Cat. No. 24170 U. S. N. M. *Allotype*: ♀ July 2, Washington, D. C. (Wm. T. Davis); author's collection. *Plesiotype*: ♂ June 27, Great Falls, Virginia (Wm. T. Davis); compared with type; author's collection. *Specimens examined*: DISTRICT OF COLUMBIA,—♂♀ May 20 to July 24, Washington (O. Heidemann). 2♂ 2♀ May 21, Petworth. 2♀ June 22, Washington (Wm. T. Davis). MARYLAND,—33♂♀ May 9, ♂ May 18, ♂ 3♀ June 8, corner Conduit and Potomac roads, on *Pinus virginiana;* ♂ May 28, 2♀ June 15, Beltsville; ♀ June 20, Odenton; 2♂ June 17, Plummers Island (W. L. McAtee). 2♀ May 24, Glen Echo (P. R. Uhler). ♀ June 15, Cabin John Run (Wm. T. Davis). ♀ July 6, Blandensburg; ♀ July 3, Forest Glen (O. Heidemann). VIRGINIA,—3♀ May 31, Four Mile Run (W. L. McAtee), ♀ May 28, Dyke. 3♀ May 30, 1883, "Va. on pine" (Pergande).

Both Heidemann and Mr. McAtee have found this species to breed on *Pinus virginiana.*

Deraeocoris albigulus new species

Closely related to *nigritulus* but differs slightly in coloration and in the structure of the male genital claspers; dark fuscous to black, basal half of hemelytra more or less pale between punctures, the paler areas not stained with brownish.

♂. Length 6.5 mm. *Head*: width 1.22 mm., vertex .55 mm., length .63 mm.; vertex slightly impressed at each side and thus causing a slight carina at basal margin; pale pubescent, black, gula and lower half of genae, sides of

tylus, spot on lorae, basal angles of juga, arcuated streak each side of front, basal margin of vertex, pale. *Rostrum,* length 2.51 mm., reaching to middle of hind coxae, piceous.

Antennae: segment I, length .48 mm., black; II, 1.68 mm., more slender on basal half and gradually enlarged toward apex, nearly attaining thickness of segment I, pubescence infuscated, length of exserted hairs greater than thickness of segment, black, more brownish on the basal one-third; III, .63 mm.; IV, .57 mm.; last two segments blackish.

Pronotum: length 1.54 mm., width at base 2.45 mm., anterior angles 1.03 mm.; collar .85 mm., black, opaque; disk and calli black, slenderly pale at basal margin, in paler forms the disk may be fusco-grayish between the punctures; lateral margins more nearly straight and the anterior angles more sharply defined than in *nigritulus;* propleura black, lower margins pale; xyphus nearly flat, pale, a dark mark at anterior angles. *Scutellum* moderately convex, shining, longly pale pubescent, black, basal angles and apex pale; mesoscutum moderately exposed, black, pubescent. *Sternum* and pleura black, opaque; ostiolar peritreme pale, infuscated at dorsal margin, sometimes tinged with reddish.

Hemelytra: width 2.9 mm., structurally very similar to *nigritulus;* fuscous to black, black color spreading from the punctures, clavus and basal half of embolium and spot on corium paler between the punctures, not stained with brown as in *nigritulus,* apical half of corium and apex of clavus piceous. *Cuneus* black, paler between punctures on basal half. *Membrane* heavily infuscated on the apical half, a ray projecting basally between the areoles, veins and slightly invading the membrane either side dark fuscous, the paler areas bordering the brachium and within the areoles fumate.

Legs: dark brownish black, in paler forms the hind tibiae indistinctly annulated with paler on the apical half; hairs on tibiae less prominent than in *nigritulus;* structure of claws and arolia very similar to those of *nigritulus.*

Fig. 33. *Deracocoris albigulus,* male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: black, shining, dusky pubescent; genital claspers (fig. 33) distinctive of the species, closely related to *nigritulus* but exhibiting specific differences.

♀. Length 7.1 mm., width 3.1 mm.; very similar to the male in form and color; segment II, length 1.94 mm., slender, thickened on the apical one-fourth but scarcely attaining the thickness of segment I, pubescence infuscated, length of exserted hairs about equal to twice greatest thickness of segment, fusco-brownish, the apical one-fourth black.

Holotype: ♂ June 30, Ithaca, New York (H. H. Knight; author's collection. *Allotype*: taken with the type on *Pinus sylvestris. Paratypes*: INDIANA,—2♂ 1♀ June 27, ♀ July 4, Miller (W. J. Gerhard). MICHIGAN,—3♀ June, Huron Mt. Club, Lake Superior (H. G. Barber). 1♂ 1♀ July 30, Marquette. NEW YORK,—♀ June 22, 2♀ June 30, 2♀ July 8, Ithaca (H. H. Knight), taken on *Pinus sylvestris.*

The writer has found nymphs and adults on *Pinus sylvestris* but the species will doubtless be found on *Pinus resinosa* also, a supposition based on the fact that three other species of Miridae, *Phytocoris pinicola* Knight, *Pilophorus sp.* and *Psallus sp.* were found to be breeding on both these pines. Since *Pinus sylvestris* is supposed to have been introduced from Europe in recent times, the species of Miridae mentioned must have bred originally only on *Pinus resinosa* for it seems quite certain these insects are not known from Europe at the present time.

KEY TO THE SPECIES OF GROUP VI

1. Hemelytra uniformly black or sepia black, the embolium sometimes pale; cuneus frequently translucent but not distinctly paler on the basal half than apex 2
   Hemelytra not uniformly black, testaceous to dark brownish, or with background pale to grayish and darkened with blackish, sometimes rufo-piceous *(rufiventris)* but in such case the cuneus is distinctly paler on the basal half; cuneus pale or reddish at least on the basal half . 4

2. Head pale along the median line of front, transversely marked with black at each side; femora brownish black, indistinctly annulated with paler near the apices . . . *comanche* n. sp. p. 177
   Head black along the median line of front or the front entirely pale, never transversely marked with black at each side of the median line; femora largely pale or entirely black, rarely annulated as the above . 3

3. Femora pale, a broad piceous annulation on the apical half; median line of frons broadly black, also black along front margin of eyes; disk of pronotum pale at the lateral margins, the median line not indicated; scutellum with never more than median line pale . . . . . *apache* n. sp. p. 179
   Femora black, sometimes with a pale annulation on the apical half, if pale on the basal half then also pale along front margin of eyes; pronotal disk frequently pale at the lateral margins but in such case the median line is also indicated in pale; scutellum frequently pale or reddish . . . . . *sayi* Reut. p. 174

4. Front of head pale or reddish, if marked with black then the calli pale and lined with black; the pronotum largely pale or fulvous . . 6
   Front of head marked with black, the calli solid black or nearly so . 5

5. Hind femora with two reddish brown bands on the apical half, tibiae annulated with brownish black at near middle, the apices broadly darkened with brown; venter piceous . . *fusifrons* n. sp. p. 180
   Hind femora with one dark brown band on the apical half, tibiae indistinctly annulated; venter testaceous, each side with a row of rounded, impressed, polished brownish black spots, one on each segment situated slightly beneath the spiracle . . . . . *fusifrons deletans* n. var. p. 181

6. Calli largely pale and lined with black, or largely black and marked with pale 8
Calli solid black 7

7. Dorsum rufo-piceous, cuneus reddish on the basal half; legs and ventral surface largely reddish, tibiae triannulate with pale . . . . . *rufiventris* n. sp. p. 184

Dorsum more or less pale yellowish to brownish, each hemelytron broadly piceous at apex of corium and again with a smaller blotch at the middle, cuneus pale on basal half; legs and ventral surface yellowish, tibiae and apical half of femora banded with reddish or piceous . . . . . *fenestratus* Van D. p. 182

8. Legs reddish, tibiae paler and biannulate with reddish brown on the basal half; disk of pronotum fulvous, becoming darker toward the basal margin; hemelytra with background pale to brownish, apex dark brown to piceous, a smaller blotch at middle and in dark specimens this may unite with the black apical area . *vanduzeei* n. sp. p. 183

Legs pale or yellowish, hind tibiae usually banded with brown near middle, also an incomplete brown annulus on apical half of femora; pronotum pallid to testaceous, frequently becoming darker on the subbasal margin 9

9. Pronotal disk sparsely pubescent, coarsely, irregularly, and deeply punctate; calli distinctly swollen; elongate, dorsum rather sparsely beset with hairs; dark coloration with a decidedly rich brownish cast . . . . . *cerachates* Uhler p. 187

Pronotal disk distinctly hairy, more finely and rather closely punctate; calli nearly flat, beset with a few hairs; form more ovate, dorsum and legs distinctly hairy; dark coloration fuscous to blackish . . 10

10. Scutellum pale or yellowish brown 11
Scutellum marked with black 12

11. Ground color chiefly honey yellow, scutellum yellowish brown, pronotal disk finely and rather closely punctate . . . . . *californicus* n. sp. p. 185

Ground color pallid and more or less bleached, pronotal disk apparently more coarsely and sparsely punctate . . . . . *californicus desiccatus* n. var. p. 187

12. Cuneus pale, darkened at apex; frons pale to yellowish . . . . . *californicus bradleyi* n. var. p. 187

Cuneus sanguineous, paler at outer margin; frons transversely marked with black each side of median line . . . . . *californicus rufocuncatus* n. var. p. 187

Deraeocoris sayi (Reuter)

1876 *Euarmosus Sayi* Reuter, Ofv. Kongl. Sv. Vet.-Akad. Forh., xxxii, No. 9, p. 76.

1909 *Camptobrochis (Euarmosus) sayi* Reuter, Acta Soc. Sci. Fenn., xxxvi, No. 2, p. 55.

1917 *Camptobrochys (Euarmosus) sayi* Van Duzee, Cat. Hemip., p. 355.

Key to the Varieties of Sayi

1. Scutellum pale or red 2
   Scutellum black, or only the median line pale apically 5

2. Lateral margins of pronotum black, or only narrowly pale at anterior angles 3
   Lateral margins of pronotum broadly pale or reddish 4

3. Front of head pale to reddish . . . *sayi sayi* Reut. p. 175
   Front of head distinctly blackish . . *frontalis* n. var. p. 177

4. Embolium black like the corium . . *marginatus* n. var. p. 176
   Embolium pale and the cuneus more or less translucent . . . . . *costalis* n. var. p. 177

5. Femora black, distinctly annulated with pale near apices . . . . . *unicolor* n. var. p. 177
   Femora distinctly pale on basal half, broadly annulated with black at middle of apical half . . . . *femoralis* n. var. p. 177

Deraeocoris sayi sayi (Reuter)

♂. Length 7.4 mm. *Head*: width 1.25 mm., vertex .6 mm., length .68 mm.; carina slight but apparent, collum broadly exposed, pale, separated from vertex by a groove; front broad and only slightly convex; facial angle a right angle or slightly greater, juga prominent, face strongly pubescent; pale to yellowish, surrounding base of antenna, lorae, bucculae, tip of tylus and sometimes a geminate mark on basal half, fuscous to blackish. *Rostrum*, length 2.34 mm., nearly attaining hind margins of the middle coxae, dark brownish to piceous.

Antennae: segment I, length .6 mm.; II, 1.77 mm., nearly cylindrical but tapering smaller at base, equal in thickness to segment I, dusky pubescent, length of exserted hairs about equal to twice the thickness of segment; III, .62 mm.; IV, .43 mm.; all the segments black.

Pronotum: length 1.6 mm., width at base 2.82 mm., anterior angles 1.14 mm.; collar .91 mm., yellowish brown; disk moderately convex, rather closely but more coarsely punctate behind the calli, lateral margins distinct, nearly straight, anterior angles narrow but distinct, strongly pubescent or hairy; black, slender basal margin, narrowly at anterior angles, and median line on disk near posterior margin, pale; calli very slightly convex, black, smooth and shining; propleura black, opaque except at dorsal margin, becoming pale at lower margin, more finely punctate than disk; xyphus nearly flat, pale to yellowish, finely pubescent. *Scutellum* moderately convex, pilose, yellowish to pink or red, the median line frequently paler; mesoscutum moderately exposed, blackish. *Sternum* fusco-brownish to black, paler at the median line; pleura blackish, paler at margins of sclerites; ostiolar peritreme dark fuscous.

Hemelytra: width 3.4 mm., embolar margin slightly arcuate; disk moderately convex, strongly pubescent or hairy, coarsely and rather closely punctate; uniformly black or brownish black. *Cuneus* moderately deflexed, black like the corium. *Membrane* and veins strongly infuscated, paler bordering tip of cuneus and apex of areoles.

Legs: black, femora indistinctly marked with a pale annulus before apex, prominently clothed with long erect hairs; tibiae black, annulated with pale at middle of basal half and more broadly at middle of apical half, thickly clothed with prominent erect hairs which in length nearly equal twice the thickness of tibia; tarsi fusco-brownish, blackish at tips; claws (fig. 2, D) deeply cleft, brownish to piceous; arolia slender, bristle-like, erect but inclined slightly forward, converging slightly at the apices.

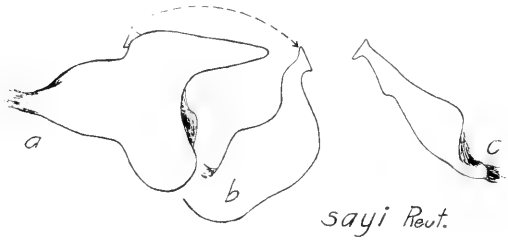

Fig. 34. *Deraeocoris sayi*, male genital claspers a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: black, shining, clothed with yellowish pubescence; genital claspers (fig. 34) distinctive of the species.

♀. Length 7.9 mm., width 3.8 mm., usually larger than the male but very similar in form and coloration; segment II, length 1.99 mm., slender, slightly thickened apically but not attaining the thickness of segment I, rather thickly clothed with prominent erect hairs, length of longest hairs equal to three times the thickness of segment at middle, fusco-brownish, black on the apical one-fourth.

Plesiotype: ♂ "Texas"; author's collection. *Specimens examined*: ALABAMA,—♂ April 5, Mobile (H. P. Loding). ILLINOIS,—♂ June 19, Glen Ellyn (W. J. Gerhard), on oak. MINNESOTA,—♀ July 2, St. Paul (A. A. Nichol). NEW YORK,—♀ June 14, Ithaca (H. H. Knight). NORTH CAROLINA,—♀ May 2, Raleigh (R. W. Leiby). TEXAS,—♀ April 11, 1♂ 1♀ May 20, Victoria (J. D. Mitchell), on live oak, *Quercus virginiana*.

In the original description Texas was cited as the type locality, but *sayi* with its color varieties is widely distributed in the eastern United States altho usually scarce in collections. Data on the above collectors' labels indicate that the species may be found most frequently on oaks.

Deraeocoris sayi marginatus new variety

Similar to the typical *sayi* but differs in being more broadly pale or reddish; lateral margins of pronotal disk broadly pale or reddish.

Holotype: ♂ June 9, Chicago, Illinois (W. J. Gerhard), at light; author's collection. *Paratypes*: FLORIDA,—3♀ April 18, St. Augustine (C. W. Johnson). GEORGIA,—♂♀ April 22 to May 12, St. Simon Island (J. C. Bradley). MICHIGAN,—♀ "Mich."

Deraeocoris sayi frontalis new variety

Differs from the typical *sayi* as indicated in the key; black, scutellum and mark on median line at base of pronotal disk pale or reddish, front of head and lower part of face largely blackish; tibiae biannulate with pale as in the typical form.

Holotypte: ♂ June 19, Glen Ellyn, Illinois (W. J. Gerhard), on oak; author's collection.

Deraeocoris sayi costalis new variety

Similar to the typical *sayi* but differs as indicated in the key; hemelytra with costal margin and cuneus largely pale, lateral margins of pronotal disk also pale.

Holotype: ♂ June 19, Pine Island, New York (Wm. T. Davis); author's collection. *Paratypes*: ILLINOIS,—♀ June 12, Galesburg (Stromberg). MASSACHUSETTS,—♀, Waltham.

Deraeocoris sayi femoralis new variety

Apparently not differing structurally from the typical *sayi* but very dissimilar in color aspect; black, cuneus except narrowly at base, and the slender costal margin pale translucent; median line of pronotal disk slightly pale near base, scutellum pale only on median line near apex; head largely black as in *frontalis;* legs largely pale, femora with a broad blackish band at middle of apical half, a series of fuscous points on the basal half; tibiae triannulate with blackish, the apical band sometimes much reduced.

Holotype: ♂ June 17, Norman County, Minnesota (A. A. Nichol); Minnesota University collection. *Allotype*: taken with the type.

Deraeocoris sayi unicolor new variety

Apparently not differing structurally from the typical *sayi* but the dorsum uniformly black; head blackish as in *frontalis,* vertex and sides of front more or less pale.

Holotype: ♂ June 18, Glen Ellyn, Illinois (W. J. Gerhard); author's collection. *Paratypes*: ILLINOIS,—♂ June 9, Chicago; ♀ June 18, ♂ June 19, Glen Ellyn (W. J. Gerhard). ♂ June 14, Galesburg (Stromberg). WISCONSIN,—♀ June 23, Beaver Dam (W. E. Snyder).

Deraeocoris comanche new species

Closely related to *sayi* but smaller and more ovate; front of head transversely marked with black each side of the median line.

♂. Length 5.7 mm. *Head*: width 1.08 mm., vertex .54 mm., length .63 mm.; facial angle practically a right angle, carina obsolete; collum black, broadly exposed, separated from vertex by a deep groove; lower face strongly pubescent, juga less prominent than in *sayi;* testaceous to pale brownish, front transversely marked with black each side of the median line, forming two arcs which meet above at front margin of vertex; a triangular mark each side of vertex and one at base of tylus, geminate mark on basal half of tylus, lorae and bucculae, dark fuscous to black. *Rostrum,* length 2.11 mm., nearly attaining posterior margins of middle coxae, brownish to piceous, darker at base and apex.

Antennae: segment I, length .44 mm.; II, 1.74 mm., gradually enlarged from base toward apex, attaining the thickness of segment I, dusky pubescent, length of exserted hairs on basal half of segment equal to more than twice greatest thickness of segment; III, .48 mm.; IV, .43 mm.; brownish black, last two segments darker.

Pronotum: length 1.25 mm., width at base 2.14 mm., anterior angles 1.05 mm., collar .8 mm.; disk moderately convex, slightly sulcate and more coarsely punctate each side of the calli on the lateral submargin, lateral margins distinct, nearly straight, anterior angles prominent, black punctate and distinctly hairy; calli convex, a pair of punctures just between, scarcely distinguished posteriorly from the disk except at latero-posterior angles, black, pale just before but a black mark extending from lateral angles to front margin of disk; disk black, shining, broadly pale at lateral margins; propleura pale to brownish, black punctate, blackish dorsally surrounding the coxal cleft; xyphus slightly convex, infuscated, longly pale pubescent. *Scutellum* moderately convex, pilose, black, the apex pale; mesoscutum black, moderately exposed. *Sternum* and pleura brownish black, basalar plate and margins of sclerites yellowish brown; ostiolar peritreme pale, becoming brownish or even blackish at dorsal margin.

Hemelytra: width 2.65 mm., embolar margin moderately arcuate; disk moderately convex, coarsely and rather uniformly punctate, clothed with prominent pubescent hairs; brownish black, shining, spot at base of corium and one next to the cuneal fracture, and the basal half of the embolium, pale translucent. *Cuneus* punctate, pubescent, colored like the corium. *Membrane* and veins strongly infuscated, paler bordering apex of cuneus.

Legs: brownish black, thickly clothed with prominent erect pale hairs; femora with an indistinct pale annulus just before apex; tibiae pale at the knee and a narrow annulus on the basal half, becoming slightly paler at apices; claws and arolia similar to those of *sayi.*

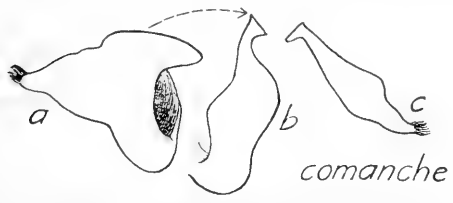

Fig. 35. *Deraeocoris comanche,* male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: brownish black or piceous, shining, yellowish pubescent; genital claspers (fig. 35) distinctive of the species.

♀. Length 6 mm., width 3 mm.; slightly larger and more ovate than the male but very similar in color; segment II, length 1.6 mm., slightly more slender than in

the male, thicker at apex but not attaining the thickness of segment I, brownish black, length of exserted hairs equal to three times thickness of segment at middle.

Holotype: ♂ June 16, Williams, Arizona (Barber & Schwarz); Cat. No. 24167 U. S. N. M. *Allotype*: July 1, Williams, Arizona (H. Barber); Cornell University collection. *Paratypes*: ARIZONA,—♀ June 7, Williams (Barber & Schwarz). 2♀ July 1, Williams (H. Barber). NEW MEXICO,—♀, "N. M."; Minnesota University collection.

Deraeocoris apache new species

Larger than *comanche,* femora pale but with a piceous annulation on the apical half.

♂. Length 7.2 mm. *Head*: width 1.22 mm., vertex .57 mm., length .74 mm.; front less vertical and the hind margin of the eyes more removed from base of head than in *comanche;* black, shining, narrow basal margin of vertex, large spot each side of front and usually connected with juga, tylus except for a geminate mark on basal half, gula, lorae and juga largely, yellowish. *Rostrum,* length 2.34 mm., reaching to middle of intermediate coxae, yellowish to brownish and becoming piceous at apex.

Antennae: segment I, length .6 mm., piceous; II, 1.88 mm., nearly cylindrical but slightly more slender near base, equal to segment I in thickness, dusky pubescent, length of exserted hairs equal to twice the thickness of segment, yellowish brown, brownish black on the apical one-third; III, .77 mm.; IV. .48 mm.; last two segments slender, brownish to fuscous.

Pronotum: length 1.57 mm., width at base 2.74 mm., anterior angles 1.17 mm.; collar .85 mm., dark brownish black, opaque; disk moderately convex; coarsely punctate, distinctly hairy, lateral margins distinct, nearly straight, anterior angles less prominent than in *comanche;* calli practically flat, slightly impressed at hind margins, a pair of widely set punctures just between, black and shining, pale just before, a black arc extending from antero-lateral angles to front margin of disk; brownish black or piceous, lateral margins of disk broadly pale but less broadly at basal angles; propleura pale or yellowish, punctures brownish, brownish black before and behind the coxal cleft; xyphus slightly convex anteriorly, brownish black, pale pubescent, the carinate margins bordering coxal cavities yellowish. *Scutellum* convex, pilose, smooth and shining, brownish black, the median line, basal angles, and apex pale, in paler forms the lateral margins may be pale from base to apex. *Sternum* brownish black, median line and margins yellowish, pleura yellowish brown, more or less brownish black on the disk of each sclerite, distinctly pilose; ostiolar peritreme pale to yellowish, dorsal margin slightly invaded with brownish.

Hemelytra: width 3.4 mm., embolar margin slightly sinuate; disk moderately convex, coarsely punctate, distinctly hairy, uniformly brownish black, shining. *Cuneus* brownish black, a small pale point at the outer basal margin. *Membrane* and veins fusco-brownish, slightly paler bordering the tip of cuneus.

Legs: pale and banded with piceous or black, distinctly hairy; femora

with a rather broad piceous band at middle of apical half, two series of fuscous points on anterior face of basal half, a secondary obsolete and more or less interrupted fuscous band just before apex; tibiae triannulate with brownish black, also a dark spot on the knee, thickly clothed with long erect hairs, length of longest hairs equal to twice the thickness of tibia; tarsi yellowish brown, darker at apices; claws and arolia similar to those of *sayi*.

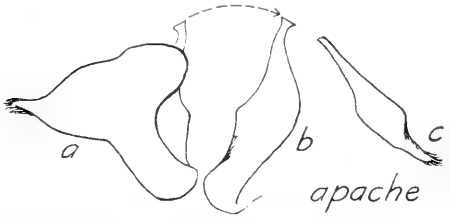

Fig. 36. *Deracocoris apache*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: brownish to piceous, paler at the sides, a series of impressed piceous spots on each side, one on each segment beneath the spiracle but somewhat removed from it; genital claspers (fig. 36) very distinctive of the species.

♀. Length 7.2 mm., width 3.4 mm.; very similar to the male in color and structure, the piceous band on femora much reduced and more brownish in color; segment II, length 1.85 mm., more slender than in the male, gradually enlarged toward apex, length of exserted hairs equal to more than three times the thickness of segment at middle, yellowish to brownish, dark brown on the apical one-fourth; segment I more reddish brown than piceous; membrane paler than in the male.

Holotype: ♂ June 20, Prescott, Arizona (H. S. Barber); Cat. No. 24168 U. S. N. M. *Allotype*: topotypic; Cornell University collection. *Paratypes*: ARIZONA,—♀ June 17, 2♀ June 19, ♂ 2♀ June 20, Prescott (H. S. Barber). ♂, "Ariz." (Uhler collection).

Deraeocoris fusifrons new species

Larger than *fenestratus*, frons marked with black, calli solid black, dorsum pale and darkened with piceous; femora pale, two reddish brown bands on the apical half.

♂. Length 6.4 mm. *Head*: width 1.14 mm., vertex .51 mm., length .65 mm.; facial angle slightly less than a right angle, structurally very similar to *fenestratus;* carina obsolete, collum black, broadly exposed, separated from the vertex by a groove, lower face strongly pubescent; pale to yellowish, bordering inner margin of eyes and projecting upon vertex, transverse marks on front each side of median line, geminate mark on basal half of tylus, spot beneath eye, dorsal half of bucculae, spot at base and the slender tip of tylus, piceous or black. *Rostrum*, length 2.19 mm., attaining hind margins of middle coxae, yellowish brown, piceous on basal segment and at apex.

Antennae: segment I, length .51 mm., yellowish brown; II, 1.6 mm., gradually enlarged from base toward apex, attaining the thickness of segment I, dusky pubescent, length of exserted hairs nearly equal to twice greatest thickness of segment, yellowish, the apical one-fourth blackish; III, .63 mm.; IV, .48 mm.; last two segments brownish to fuscous.

Pronotum: length 1.42 mm., width at base 2.42 mm., anterior angles 1.2 mm., collar .83 mm.; disk convex, coarsely but sparsely punctate, longly pubes-

cent or hairy, lateral margins distinct, nearly straight, anterior angles rounded but distinct; calli convex, subconfluent, black, invaded by pale at the latero-anterior angles from which a black arc extends to front margin of pronotal disk; disk testaceous, becoming piceous on the basal one-third each side of the median line, punctures piceous, more sparsely and irregularly placed just behind the calli; propleura testaceous to brownish, black punctate; xyphus slightly convex, infuscated, pale pubescent. *Scutellum* convex, smooth and shining, pilose, testaceous, black vitta each side of median line which fuse at base; mesoscutum moderately exposed, black, brownish at the lateral angles. *Sternum* brownish black, paler at the median line and around the margins, pleura yellowish to brownish; ostiolar peritreme pale to yellowish, a blackish spot just above.

Hemelytra: width 3 mm., embolar margin slightly arcuate; disk convex, coarsely black punctate, thickly clothed with prominent pubescent hairs; piceous or black, more or less pale between the punctures on the clavus, basal half of embolium, spot near base, and at apical inner angles of corium; more nearly black at tip of clavus, large spot on middle and broadly across apex of corium and embolium. *Cuneus* pale, apical half and narrowly at base black, punctures concolorous. *Membrane* fusco-brownish, slightly darker on veins and at either side, paler near tip of cuneus and basal half of areoles.

Legs; pale, vestiture of hairs shorter and less prominent than in *fenestratus;* femora with two reddish brown bands on apical half, interrupted below and on posterior face; tibiae with a brownish or piceous band at middle, the apices broadly darkened with brownish, clothed with suberect hairs which in length scarcely exceed thickness of tibiae; claws deeply cleft, arolia slender, bristle-like, erect, nearly parallel but converging slightly at apices.

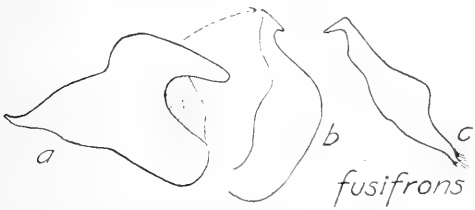

Fig. 37. *Deraeocoris fusifrons*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: dark brownish to piceous, yellowish pubescent; genital claspers (fig. 37) distinctive of the species.

Holotype: ♂ May, Santa Clara County, California (Coleman); author's collection. *Paratype*: ♂, taken with type.

Deraeocoris fusifrons deletans new variety

♀. Length 5.7 mm., width 3 mm. Structurally very similar if not identical with the typical *fusifrons*, also the piceous coloration of head and dorsum very similar but more broadly pale on hemelytra, embolar margin more distinctly arcuate; femora with only one dark brown band on anterior face of the apical half, tibiae indistinctly marked with brown at middle; venter testaceous, each side with a row of rounded, impressed, polished brownish black spots, one on each segment situated slightly beneath the spiracle; membrane pale fuliginous. *Antennae*: segment I, length .48 mm., yellowish brown; II, 1.57 mm.,

slender, gradually thickened toward apex but not attaining the thickness of segment I, length of longest exserted hairs equal to three times the greatest thickness of segment, yellowish, the apical one-fourth blackish; III, .65 mm.; IV, .45 mm.; last two segments brownish and darkened with fuscous.

Holotype: ♀ August, Marin County, California; Cornell University collection.

Deraeocoris fenestratus (Van Duzee)

1917 *Camptobrochis fenestratus* Van Duzee, Proc. Calif. Acad. Sci., ser. 4, vii, p. 266.

Length 5.5-6 mm. Suboval, yellowish to reddish and piceous, punctured and marked with black, shining; margins of pronotum and hemelytra hairy; front of head and vertex devoid of black marks.

Length 5.5 mm. *Head*: width 1.05 mm., vertex .51 mm., length .77 mm.; more produced than in *fulvescens*, front moderately convex, polished, carina obsolete, collum broadly exposed and elevated slightly above vertex, brownish; yellowish to reddish, geminate mark on basal half of tylus and narrowly at apex, epipharynx, dorsal margins of lorae and bucculae, piceous. *Rostrum*, length 2.4 mm., scarcely attaining posterior margins of hind coxae, first segment attaining base of head; brownish, basal segment reddish, the apical one piceous.

Antennae: segment I, length .48 mm., yellowish, slightly darker beneath, certain hairs equaling thickness of segment: II, 1.65 mm., slender, yellowish, the apical one-fourth slightly thicker and blackish in color, clothed with prominent pale hairs, length of several being three times the thickness of segment; III, .68 mm., yellowish; IV, .57 mm., slightly infuscated.

Pronotum: length 1.22 mm., width at base 2.17 mm.; anterior angles .94 mm., slightly rounded; collar .77 mm., finely granulate, brownish; disk pilose, distinctly hairy at lateral margins, yellowish to rich brownish, sub-basal areas becoming piceous (disk practically black in one specimen); punctures coarse, black, irregularly but not densely punctate; calli flat, black and shining, a piceous arc extending to anterior angles; propleura yellowish brown, in darkest specimens becoming piceous above, xyphus reddish. *Scutellum* impunctate, shining, somewhat pilose, piceous, basal angles and median line pale; mesoscutum brownish, scarcely exposed. *Sternum* and pleura brownish to reddish, dull; ostiolar peritreme pale but with some reddish.

Hemelytra: width 2.72 mm., convex, embolium arcuated from base to apex, cuneus and membrane deflexed; pilose, longest hairs on embolium; coarsely and irregularly punctate, punctures black; shining, yellowish to brownish, more or less translucent, corium broadly piceous at apex, more or less joined with a large spot at middle; embolium pale, piceous at apex and darkened along the extreme outer edge. *Cuneus* pale, inner basal angle and apical one-third piceous. *Membrane* fuliginous, darker bordering the veins, faintly paler at tip of cuneus and tending to become a transverse band; veins dark brownish.

Legs: pale yellowish to brownish, strongly pilose, long hairs on tibiae equal to at least twice the thickness of tibia; apical half of femora brownish or red-

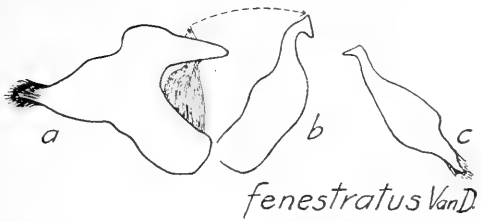

Fig. 38. *Deraeocoris fenestratus*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

dish, indistinctly annulated with paler; tibiae pale, broadly banded at apex, middle, and more narrowly near base with brownish or reddish; tarsi pale, fuscous at apices.

Venter: reddish, shining, becoming piceous on the genital segment, strongly pilose; genital claspers (fig. 38) distinctive of the species.

♀. Length 5.7 mm., width 2.85 mm.; very similar to the male in all respects except the genital segment.

Plesiotype: *paratype*, ♂ Aug. 21, 1916, Fallen Leaf Lake, Eldorado Co., California (W. M. Giffard); collection of E. P. Van Duzee.

Specimens examined: paratype, same data as plesiotype. ♂♀, September, Placer Co., California.

Deraeocoris vanduzeei new species

Very suggestive of *fenestratus* but smaller, more ovate, calli marked with black; distinguished by the genital claspers, particularly in the form of the internal arm of the left clasper.

♂. Length 4.6 mm. *Head*: width .97 mm., vertex .48 mm., length .54 mm.; structurally nearly identical with *fenestratus;* yellowish brown and tinged with reddish, geminate mark on tylus nearly obsolete. *Rostrum*, length 1.88 mm., reaching upon middle of the hind coxae, brownish and tinged with red.

Antennae: segment I, length .4 mm., yellowish, darkened with reddish or brown; II, 1.28 mm., slender, thickened apically and nearly equaling segment I in thickness, the longest exserted hairs nearly equal to three times the greatest thickness of segment, yellowish, the apical one-third black; III, .6 mm.; IV, .45 mm.; last two segments yellowish to brownish.

Pronotum: length 1.08 mm., width at base 1.97 mm., anterior angles .85 mm., collar .68 mm.; disk convex, punctures much finer than in *fenestratus*, lateral margins distinct, nearly straight, anterior angles rounded and distinctly narrowed; calli slightly convex, brownish, front margin and somewhat between, line on the hind margin with recurved hook at latero-posterior angle, mark on disk of each which extends toward latero-anterior angle and frequently joins spot at front margin of pronotal disk, black; disk largely fulvous, darker near basal margin where the piceous coloration spreads from the punctures, beset with prominent pale pubescence, hairs longest at lateral margins and anterior angles; propleura yellowish, finely punctate; xyphus nearly flat, reddish, pale pubescent. *Scutellum* strongly convex, smooth and shining, margins pubescent, dark brownish black or piceous, basal angles broadly and the apex narrowly pale; mesoscutum slightly exposed, blackish, brownish at lateral angles. *Sternum* and pleura yellowish to reddish; ostiolar peritreme yellowish and tinged with reddish.

Hemelytra: width 2.48 mm., embolar margin strongly arcuated; disk convex, shining, finely pubescent, coarsely and rather irregularly black punctate; ground color pale to testaceous, piceous surrounding each puncture and spreading to connect in groups, tip of clavus, spot at base and larger one at middle of corium, broadly across apices of corium and embolium, brownish black or piceous. *Cuneus* pale, opaque, punctures chiefly concolorous, basal angle and apical half brownish black. *Membrane* practically hyaline, the anal margin and a small point at tip of smaller areole fuscous, brachium frequently infuscated.

Legs: yellowish and darkened with reddish; femora strongly reddish on apical half, an indistinct paler band before apex, the extreme tips also more yellowish; tibiae biannulate on basal half with reddish, also a spot on knee, broadly brownish at apices; tarsi yellowish brown; claws deeply cleft, arolia slender, bristle-like, erect, nearly parallel but converging slightly at apices.

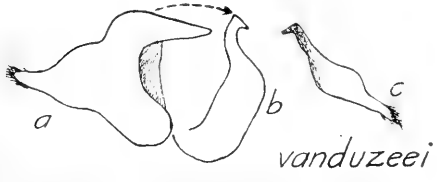

Fig. 39. *Deraeocoris vanduzeei*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: reddish, shining, pale pubescent; genital claspers (fig. 39) distinctive of the species.

♀. Length 4.9 mm., width 2.65 mm.; very similar to the male in form and color; segment II, length 1.6 mm., only very slightly more slender than in the male, exserted hairs and coloration not differing from male.

Holotype: ♂ June 5, San Diego County, California (E. P. Van Duzee); collection of E. P. Van Duzee. *Allotype*: same data as the type. *Paratypes*: CALIFORNIA,—2♀ June 5, ♀ June 7, ♂ June 12, ♀ June 19, San Diego County (E. P. Van Duzee). 1♂ 1♀, Los Angeles County (Coquillett). ♀ June 9, Pasadena (Grinnell).

Deraeocoris rufiventris new species

Closely related to *vanduzeei* but larger and differently colored; dorsum rufo-piceous, cuneus reddish on the basal half, legs and ventral surface largely reddish.

♂. Length 5.3 mm. *Head*: width 1.03 mm., vertex .51 mm., length .6 mm.; structurally very similar to *vanduzeei;* yellowish to reddish, rather broadly at apex and geminate mark on basal half of tylus, bucculae, and dorsal margin of lorae, brownish to piceous. *Rostrum*, length 2.17 mm., attaining posterior margins of middle coxae, yellowish to brown, piceous toward apex.

Antennae: segment I, length .48 mm., fusco-brownish; II, 1.51 mm., gradually thickened from base toward apex, scarcely attaining the thickness of segment I, dusky pubescent, length of longest exserted hairs equal to twice greatest thickness of segment, yellowish, apical two-fifths black; III, .62 mm., yellowish, dusky at apex; IV, .45 mm., fusco-brownish.

Pronotum: length 1.22 mm., width at base 2.14 mm., anterior angles .88

mm.; collar .71 mm., opaque, brownish; disk rufo-piceous, coarsely and rather irregularly punctate, beset with numerous long erect hairs, longest at lateral margins; calli slightly convex, more nearly black than central area of pronotal disk; propleura dark reddish, piceous above, more coarsely punctate bordering the dorsal margin; xyphus convex anteriorly, reddish. *Scutellum* strongly convex as in *vanduzeei,* smooth and shining, rufo-piceous, paler at slender apex and basal angles. *Sternum* and pleura dark reddish; ostiolar peritreme reddish.

Hemelytra: width 2.74 mm., structurally nearly as in *vanduzeei;* rufo-piceous, more reddish brown between the punctures on clavus. *Cuneus* with coagulated red, apical one-third and narrowly at inner basal angle piceous, punctures concolorous. *Membrane* fuliginous, slightly paler bordering tip of cuneus, veins and apical half of areoles darker.

Legs: sanguineous to dark red, femora with an indistinct paler band on apical half; tibiae more distinctly hairy than in *vanduzeei,* triannulate with pale, broadest band at middle of apical half, the second at middle of basal half, third and narrowest band just beneath the knee; tarsi yellowish to fuscous; claws and arolia similar to those in *vanduzeei.*

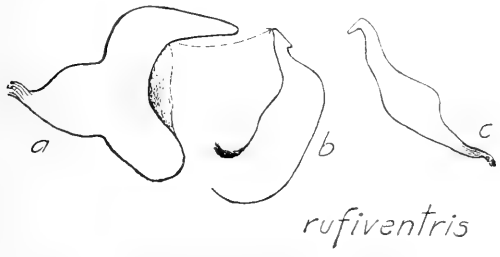

Fig. 40. *Deraeocoris rufiventris,* male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: sanguineous to rufo-piceous, pale pubescent; genital claspers (fig. 40) distinctive but exhibiting a close relationship with *vanduzeei.*

♀. Length 5.3 mm., width 2.87 mm.; very similar to the male but slightly more robust; segment II, length 1.54 mm., only very slightly more slender than in male, yellowish, tinged with red near base, the apical one-fourth black.

Holotype: ♂ June 28, San Diego County, California (E. P. Van Duzee); collection of E. P. Van Duzee. *Allotype*: same data as the type. *Paratypes*: 7♂ 5♀, taken with the types.

Deraeocoris californicus new species

Ground color chiefly honey yellow, scutellum yellowish brown, hind tibiae with a brown annulus near middle, also a brown band on apical half of femora; pronotal disk distinctly hairy, finely and rather closely punctate.

♂. Length 6.2 mm. *Head*: width 1.08 mm., vertex .52 mm., length .65 mm.; carina obsolete, collum moderately exposed, brownish, separated from vertex by a groove; strongly pubescent or hairy, shining; testaceous, geminate mark on basal half of tylus, spot beneath front margin of eye, slender dorsal margin of lorae, reddish brown to piceous. *Rostrum,* length 2.28 mm., attaining hind margins of middle coxae, testaceous, darker apically.

Antennae: (missing in the only male specimen).

Pronotum: length 1.42 mm., width at base 2.48 mm., anterior angles 1.05

mm., collar .85 mm.; disk moderately convex, distinctly hairy, finely and rather closely punctate, lateral margins distinct, very slightly sinuate, anterior angles rounded; honey yellow or slightly brownish, punctures concolorous; calli marked with black, a line bordering hind margin, recurved slightly at outer angles and joined at middle, an arc bordering inner anterior angles, a transverse line on disk of each but frequently interrupted, sometimes extending to join with a black mark near anterior angles of pronotal disk; xyphus slightly convex anteriorly, pale pubescent. *Scutellum* convex, smooth and shining, pilose, brownish, slightly paler at basal angles and apex. *Sternum* and pleura testaceous to brownish; ostiolar peritreme pale.

Hemelytra: width 3.1 mm.; embolar margin straight along middle, rounded slightly near each end; moderately convex, heavily pubescent or hairy, rather finely punctate, punctures infuscated; testaceous or honey yellow, corium with spot at middle, smaller one at base, a broad spot at outer apical angle and slightly invading the embolium, brownish black. *Cuneus* pale, narrowly at inner basal angle and frequently the apex dark brownish, punctures concolorous. *Membrane* pale fuliginous, veins dark brown.

Legs: thickly clothed with prominent pale hairs, testaceous; femora with a dark brown mark on dorsal and anterior face near middle of apical half; hind tibiae with brownish band at middle, sometimes nearly obsolete; claws deeply cleft, arolia slender, bristle-like, erect, nearly parallel but slightly converging at apices.

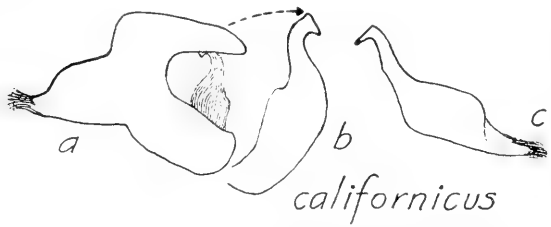

Fig. 41. *Deraeocoris californicus*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: testaceous, becoming more or less tinged with reddish, pale pubescent; genital claspers (fig. 41) distinctive of the species but exhibiting a close relationship with *cerachates*.

♀. Length 6.3 mm., width 3 mm.; very similar to the male in form and coloration but the blackish spots on hemelytra much reduced in size, frequently absent from apex of corium. *Antennae*: segment I, length .54 mm.; II, 1.68 mm., slender, slightly enlarged at apex but not attaining the thickness of segment I, clothed with erect pale hairs, length of longest hairs equal to three times greatest thickness of segment; III, .65 mm.; IV, .45 mm.; all segments yellowish, very little darker at apex of segment II.

Holotype: ♂, Los Angeles County, California (Coquillett); Cornell University collection. *Allotype*: June 8, San Diego County, California (E. P. Van Duzee). *Paratypes*: CALIFORNIA,—♀, taken with the allotype. ♀, "Los Ang." [Los Angeles] (Uhler collection).

Deraeocoris californicus desiccatus new variety

♂. Length 5.5 mm., width 2.59 mm. Structurally very similar to if not identical with the typical *californicus;* ground color pallid and more or less bleached, pronotal disk coarsely, deeply, and more sparsely punctate than in *californicus,* punctures on sub-basal margin becoming piceous; black marks on calli distinctly piceous while blackish spots on corium are nearly obsolete.

Antennae: segment I, length .45 mm.; II, 1.48 mm., gradually enlarged from base to middle, nearly cylindrical on apical half and equal to segment I in thickness, pale pubescent, length of longest exserted hairs equal to twice greatest thickness of segment, pale, becoming brownish near apex; III, .57 mm., brownish; IV, missing.

♀. Length 5.6 mm., width 2.9 mm., embolar margin more distinctly arcuate than in the typical *californicus;* more pallid than in the male, infuscations of hemelytra nearly obsolete but the piceous markings on calli equally distinct.

Holotype: ♂, September, Palo Alto, California (J. C. Bradley); Cornell University collection. *Allotypes*: taken with the type. *Paratypes*: 2♀, August, San Francisco, California (J. C. Bradley).

Deraeocoris californicus bradleyi new variety

♀. Length 5.6 mm., width 2.9 mm.; very similar in structure to the typical *californicus* but smaller, more ovate, and darker in color; frons testaceous, pronotum with punctures piceous on the sub-basal margin, calli heavily lined with black as in *desiccatus;* scutellum pale, piceous on the median line, or the median line pale and leaving a vitta each side, the vittae sometimes constricted at middle thus tending to form four piceous spots; corium broadly piceous across apex, a large spot at middle and a smaller one at base; membrane pale fuscous, paler near tip of cuneus, veins darker fuscous.

Holotype: ♀, August, San Francisco, California (J. C. Bradley); collection of E. P. Van Duzee. *Paratypes*: 2♀, taken with the type.

Deraeocoris californicus rufocuneatus new variety

♀. Length 5.7 mm., width 2.9 mm.; very similar to *bradleyi* but differs as indicated in the key; cuneus sanguineous, paler at outer margin, frons transversely marked with black each side of median line, also black bordering front margin of eye and projecting in a spur upon vertex.

Holotype: ♀ June 2, Mission Canyon, Santa Barbara, California, (Harold Morrison); author's collection.

Deraeocoris cerachates Uhler

1894 *Deracocoris cerachates* Uhler, Proc. Calif. Acad. Sci., ser. 2, iv, p. 265.

1917 *Camptobrochys (Mycterocoris) cerachates* Van Duzee, Cat. Hemip., p. 355.

Pale yellowish to rich brownish, becoming blackish on corium and clavus, head marked with black, calli lined with piceous; pubescence moderate, not conspicuously hairy, dorsum with long hairs only at anterior angles of pronotum; erect hairs on antennae scarcely greater than twice the thickness of segment II.

♂. Length 6.7 mm. *Head*: width 1.17 mm., vertex .57 mm., length .83 mm.; carina very feeble, front moderately convex, smooth and shining; yellowish and marked with brown and black, front each side of median line, bordering inner margin of eye and projecting toward the median line on vertex, geminate mark on basal half of tylus with median spot at base, dorsal half of lorae and a spot at base of genae, brownish to black. *Rostrum*, length 2.28 mm., scarcely attaining the posterior margins of middle coxae, yellowish, becoming blackish at apex.

Antennae: segment I, length .54 mm., slightly infuscated beneath, clothed with pale hairs, the longest of which are little greater than the thickness of the segment; II, 1.65 mm., slender, slightly but gradually thickened from base (.057 mm.) to apex (.095 mm.), apical one-fourth infuscated, clothed with several erect pale hairs, the longest of which are little greater than twice thickness of segment; III, .63 mm., infuscated, fine erect hairs equal to twice the thickness of the segment; IV, .51 mm., infuscated.

Pronotum: length 1.34 mm., width at base 2.45 mm., anterior angles 1.14 mm., collar .88 mm.; disk deeply and irregularly but not densely punctate, moderately convex, lateral margins distinctly sulcate, slenderly carinate, more distinctly so on the basal half; anterior margin and angles clothed with fine pale hairs, the discal area very finely pubescent; calli convex, smooth and shining, confluent, pale between and just before, delimited behind by a heavy black line which is recurved at the outer margin, anterior inner angles broadly black, an irregular disconnected line running through the middle and curving toward a heavy black spot at the anterior angles of disk; disk yellowish to rich brown, becoming blackish on the sub-basal margin, narrow basal margin and the median line distinctly pale; propleura yellowish to brownish, the coxal margin anterior to the coxal cleft very prominent, distinctly flaring; xyphus pale, pubescent, a distinctive black spot at each anterior angle just before the coxa. *Scutellum* impunctate, shining, convex, finely pubescent; pale, black each side of the median line and becoming brown at base, mesoscutum brown. *Sternum* and pleura yellowish.

Hemelytra: width 3.1 mm.; coarsely and deeply punctate, shining, finely pale pubescent; pale, punctures of clavus and corium black, the dark color spreading to connect with adjacent punctures, apex of corium and a large irregular spot at middle blackish; embolium prominent, pale, invaded by blackish at apex, from base to apex slightly arcuated. *Cuneus* pale, black across the inner basal margin, narrow apex blackish. *Membrane* fumate, slightly darker on the apical half, paler near tip of cuneus, veins brownish.

Legs: pale to yellowish, not unusually hairy, longest hairs on femora scarcely equal to the thickness of that member, length of hairs on tibia scarcely greater than thickness of tibia; hind femora with an indistinct brown mark on anterior face just beyond middle, a faint indication of a second mark nearer the apices; tibiae becoming brownish at apices, the hind pair with an indistinct brown band at middle; tips of tarsi fuscous.

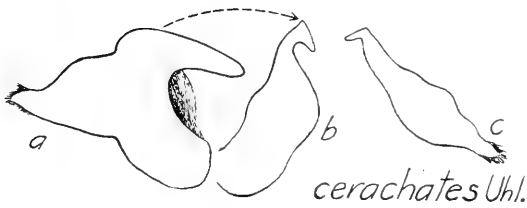

Fig. 42. *Deraeocoris cerachates*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: brownish, becoming piceous on sides of genital segment, the sides with a series of large piceous spots, one on each segment just beneath the spiracle; finely pale pubescent; genital claspers (fig. 42) distinctive of the species.

♀. Length 6.4 mm., width 3 mm.; very similar to the male but the black coloration much reduced, membrane nearly clear; segment II, length 1.68 mm., slender, only very slightly thickened at apex, length of exserted hairs about equal to three times thickness of segment, yellowish; sides of venter obscurely marked with a row of brown spots.

Allotype: ♂ June 9, Santa Cruz County, California, alt. 600 ft. (W. M. Giffard); collection of California Academy of Sciences.

Specimens examined: CALIFORNIA,— ♀ July 10, Clayton, Shasta County (E. P. Van Duzee). ♀ July 15, Pescadero, San Mateo County. OREGON,— ♂ June 8, Josephine County (F. W. Nunenmacher).

This species was described by Uhler from a single female specimen from San José del Cabo, Lower California, and is now preserved in the collection of the California Academy of Sciences.

The present description is drawn from a male specimen which Mr. Van Duzee has compared with the type and pronounced identical. Uhler states in the original description: "rostrum reaching over the posterior coxae." At the writer's request Mr. Van Duzee sent the following notes on the type: "The rostrum scarcely passes the apex of the intermediate coxae, it is flexed somewhat and the best one can do is to estimate. Uhler might easily have thought it would pass over the base of the hind coxae, and it might altho I would estimate it as just attaining the apex of the intermediate. The callosites are outlined in piceous."

KEY TO THE SPECIES AND VARIETIES OF GROUP VII

1. Head except tylus, pronotum, scutellum, and hemelytra except apex of cuneus, reddish . . . . . *ruber ruber* Linn. p. 191
   Hemelytra or pronotum, or both, more or less blackish . . . 2
2. Hemelytra reddish, pronotal disk black or largely blackish . . . . . *ruber bicolor* n. var. p. 193
   Hemelytra and pronotum more or less blackish 3
3. Pronotal disk largely, scutellum, corium and embolium except apically, reddish . . . . . *ruber danicus* Fabr. p. 193

Pronotum, scutellum, hemelytra except narrowly at base of embolium and corium, black 4

4. Cuneus reddish on the basal half . *ruber segusinus* Müller p. 193
Cuneus entirely black . . . . *ruber concolor* Reut. p. 194

Deraeocoris ruber (Linnaeus)

1758 *Cimex ruber* Linnaeus, Syst. Nat., edn. 10, p. 446.
1761 *Cimex ruber* Linnaeus, Faun. Suec., p. 251.
1761 *Cimex gothicus b.* Poda, Insecta Musei Graecensis, p. 57. (not Linnaeus)
1763 *Cimex gothicus* Scopoli, Ent. Carn., p. 131. (not Linnaeus)
1764 *Cimex No. 17* Geoffroy, Hist. Abreg. des Ins., i, p. 444.
1764 *Cimex No. 50* Geoffroy, Hist. Abreg. des Ins., i, p. 459.
1767 *Cimex ruber* Linnaeus, Syst. Nat. edn. 12, i, p. 723.
1767 *Cimex laniarius* Linnaeus, Syst. Nat., edn. 12, i, p. 726.
1775 *Cimex capillaris* Fabricius, Syst. Ent., p. 725.
1776 *Cimex cimbricus* Müller, Zool. Danicae Prodr., p. 106.
1778 *Cimex cimbricus* Goeze, Ent. Beytr., ii, p. 252.
1778 *Cimex croceus* Goeze, Ent. Beytr., ii, p. 265.
1778 *Cimex rubro-acuminatus* Goeze, Ent. Beytr., ii, 268.
1778 *Cimex luteus* Goeze, Ent. Beytr., ii, p. 278.
1778 *Cimex biguttatus* Goeze, Ent. Beytr., ii, p. 278.
1781 *Cimex capillaris* Fabricius, Species Ins., ii, p. 372.
1781 *Cimex gothicus* Schrank, Enum. Ins. Austr., p. 283. (not Linnaeus)
1781 *Cimex rubens* Harris, Expos. Eng. Ins., p. 90, pl. 26, fig. 10.
1781 *Cimex melinus* Harris, Expos. Eng. Ins., p. 90, pl. 26, fig. 11.
1785 *Cimex croceus* Geoffroy *in* Fourcroy, Ent. Paris., i, p. 200.
1785 *Cimex flammeus* Geoffroy *in* Fourcroy, Ent. Paris., i, p. 210.
1787 *Cimex capillaris* Fabricius, Mantissa Ins., ii, p. 305.
1788 *Cimex rufescens* Gmelin, *in* Linnaeus, Syst. Nat., edn. 13, iv, p. 2160.
1788 *Cimex fuliginosus* Gmelin, *in* Linnaeus, Syst. Nat., edn. 13, iv, p. 2164.
1788 *Cimex chrysocephalus* Gmelin, *in* Linnaeus, Syst. Nat., edn. 13, iv, p. 2164.
1788 *Cimex haematocephalus* Gmelin, *in* Linnaeus, Syst. Nat., edn. 13, iv, p. 2166.
1788 *Cimex haematostictos* Gmelin, *in* Linnaeus, Syst. Nat., edn. 13, iv, p. 2181.
1788 *Cimex adustus* Gmelin, *in* Linnaeus, Syst. Nat., edn. 13, iv, p. 2185.
1790 *Cimex gothicus* Rossi, Fauna Etrusca, ii, p. 249. (not Linnaeus)
1794 *Lygaeus capillaris* Fabricius, Ent. Syst., iv, p. 180.
1801 *Cimex bimaculatus* Schrank, Fauna Boica, 1801, p. 88.
1801 *Cimex olivaceus* Schrank, Fauna Boica, 1801, p. 89. (not Fabricius)
1803 *Capsus capillaris* Fabricius, Syst. Rhyng., p. 244.
1804 *Capsus capillaris* Latreille, Hist. Nat. Crust. Ins., xii, p. 232.
1806 *Cimex geniculatus* Turton, Syst. Nat., ii, p. 687.
1835 *Capsus capillaris* Burmeister, Handb. d. Ent., ii, p. 274.
1840 *Phytocoris (Capsus) capillaris* Blanchard, Hist. des Ins., Hemip., p. 139.
1843 *Capsus capillaris* Amyot et Serville, Hist. Nat. Ins., Hemip., p. 281.
1852 *Capsus capillaris* Costa, Cimic. Reg. Neap., Cent., iii, p. 44.
1861 *Capsus capillaris* Fieber, Eur. Hemip., p. 266.
1865 *Capsus capillaris* Douglas and Scott, Brit. Hemip., p. 442, pl. 14, fig. 8.

1868 *Deraeocoris capillaris* Stål, Hem. Fabr., i, p. 87.
1869 *Capsus capillaris* Puton, Cat. Hem. Het., p. 23.
1871 *Capsus (Capsus) capillaris* Thomson, Opusc. Ent., iv, p. 430.
1875 *Deraeocoris laniarius* Reuter, Rev. Crit. Caps., [ii], p. 72.—Acta Soc. Faun. Fl. Fenn., i, p. 88.
1875 *Capsus laniarius* Puton, Cat. Hemip., edn. 2, p. 68.
1875 *Capsus laniarius* Saunders, Trans. Ent. Soc. London, 1875, p. 271.
1876 *Capsus laniarius* Reiber et Puton, Cat. Hem. Het. l'Alsace et Lorraine, p. 26.
1878 *Capsus capillaris* Uhler, Proc. Bost. Soc. Nat. Hist., xix, p. 408.
1886 *Capsus laniarius* Puton, Cat. Hem. Palearc., edn. 3, p. 51.
1886 *Deraeocoris capillaris* Uhler, Check List Hemip., p. 19.
1888 *Deraeocoris segusinus* Reuter, Acta Soc. Sci. Fenn., xv, p. 649, No. 254.
1890 *Deraeocoris seguisinus* Atkinson, Cat. Capsidae, p. 100.
1892 *Capsus laniarius* Saunders, Het. Brit. Isds., p. 260.
1895 *Capsus laniarius* Douglas, Ent. Mon. Mag., ser. 2, vi, p. 238.
1896 *Deraeocoris segusinus* Reuter, Hem. Gymn. Eur., v, p. 32.
1899 *Capsus ruber* Puton, Cat. Hem. Palearc., edn. 4, p. 64.
1902 *Deraeocoris segusinus* Hüeber, Jahr. ver. Nat. Württ., 1902, p. 102; (Sep.) Synop. deut. Blindw., i, p. 394.
1905 *Deraeocoris segusinus var. capilaris* Heidemann, Jour. N. Y. Ent. Soc., xiii, p. 48.
1908 *Deraeocoris ruber* Horváth, Ann. Mus. Natl. Hung., vi, p. 5.
1909 *Deraeocoris ruber* Oshanin, Verz. Palae. Hemip., i, p. 755.
1910 *Deraeocoris seguisinus* Banks, Cat. Nearc. Hem. Het., p. 43.
1912 *Deraeocoris ruber* Oshanin, Kat. Palae. Hemip., p. 67. (as pseudotype)
1912 *Capsus seguisinus* Jensen-Haarup, Danmarks Fauna, xii, p. 233.
1917 *Deraeocoris ruber* Parshley, Occas. Papers Bost. Soc. Nat. Hist., vii, Fauna N. E. 14, Hem. Het., p. 93.
1917 *Deraeocoris ruber* Van Duzee, Cat. Hemip., p. 356.
1920 *Deraeocoris ruber* J. Sahlberg, Bidrag Känn. Finl. Nat. Folk, lxxix, No. 2, p. 128.

Deraeocoris ruber ruber (Linnaeus)

♀. Length 7.2 mm. *Head*: 1.37 mm., vertex .65 mm., length .83 mm.; tylus strongly compressed, outline of head appearing nearly triangular when viewed from above, vertex equal in width to the collum, eyes sloping forward away from collar, broadly oval when viewed from the side; vertex ecarinate, sloping backward and downward at posterior margin of eyes, collum moderately exposed, abruptly elevated above the vertex; front convex, smooth and shining, tylus prominent, facial angle equal to a right angle, lower face finely pubescent; fulvo-testaceous, tylus, dorsal margin of bucculae, small spot on vertex at dorsal margin of eye and sometimes a spot at median line of front, black. *Rostrum*, length 2.9 mm., reaching to middle of hind coxae, brownish to brownish black, paler at the joints.

Antennae: segment I, length .8 mm., reaching beyond tip of tylus by slightly more than half its length, piceous; II, 2.42 mm., slender on basal half but thickened apically, nearly attaining the thickness of segment I, the clavate

portion more thickly and closely set with short stiff black hairs, longest hairs not exceeding greatest thickness of segment, piceous, yellowish brown on the middle one-third; III, 1 mm., slender, tapering from base to more slender at apex, yellowish; IV, .54 mm., fusco-brownish.

Pronotum: length 1.74 mm., width at base 2.68 mm., anterior angles .97 mm. collar .85 mm.; disk strongly convex but more so on the basal half, deeply and rather closely but irregularly punctate, immarginate, much narrowed anteriorly, little wider than collar at anterior margin; calli small, slightly convex, subconfluent, extending to anterior margin of pronotal disk, irregularly delimited behind by coarse punctures, not differing in color from the adjoining disk; reddish yellow or fulvo-testaceous, finely pubescent, punctures becoming piceous; propleura punctate, punctures concolorous; xyphus flat, finely pubescent. *Scutellum* convex, rather sparsely and finely punctate, shining, finely pubescent, reddish yellow; mesoscutum slightly exposed, piceous. *Sternum* reddish, becoming darker each side of the median line; pleura reddish, shining, finely pubescent; ostiolar peritreme pale, sometimes tinged with yellowish.

Hemelytra: width 3.4 mm., embolar margin nearly straight along middle, rounding in to the fracture at distal end; moderately convex, nearly glabrous, shining, rather finely but closely punctate, largest punctures on clavus near scutellum, punctures concolorous, a few becoming piceous; fulvo-testaceous to reddish, outer edge of embolium, slender outer margin of corium near apex, and slender edges of the commissure, piceous. *Cuneus* sanguineous, paler at outer margin, apex black. *Membrane* infuscated, slightly paler near tip of cuneus, veins brownish black, the darker color invading the membrane slightly each side.

Legs: brownish black, apical one-fourth of femora reddish except for a blackish line on the dorsal face; tibiae yellowish to reddish, becoming infuscated at apices and on dorsal surface near base, anterior face with a row of distinct colored spines, pubescent hairs short; tarsi fusco-brownish, claws deeply cleft (fig. 2, F); arolia slender, bristle-like, erect, nearly parallel but slightly converging at the apices.

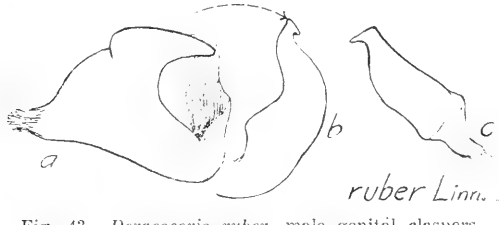

Fig. 43. *Deraeocoris ruber*, male genital claspers. a, left clasper, lateral aspect; b, internal arm of left clasper; c, right clasper, lateral aspect.

Venter: piceous, broadly reddish on the sides, finely pubescent; male genital claspers are figured from variety *segusinus*.

Plesiotype: ♀ July 14, Brooklyn, New York (Wm. T. Davis); author's collection. *Specimens examined*: CONNECTICUT,—♀ June 27, New Haven (B. H. Walden). ♀ July 9, ♀ July 21, New Haven (M. P. Zappe). NEW YORK,—♀ July 2, Maspeth, Long Island (C. E. Olsen).

Males of this variety are evidently scarce, indicating that the males tend to be darker colored than the females.

Deraeocoris ruber bicolor new variety

♂. Similar to the typical variety except that the pronotum is black; sometimes the lateral margins of the disk and the slender median line reddish.

Holotype: ♂ June 30, New Haven, Connecticut (M. P. Zappe); author's collection. *Specimens examined*: CONNECTICUT,—♂ July 1, New Haven (M. P. Zappe). ♀ June 26, Hartford (W. Marchand). NEW YORK,—♂ July 14, Brooklyn (W. T. Davis).

This variety apparently represents the pale color phase of the male. As is true in many species of Miridae, the males of *ruber* are normally darker colored than the females.

Deraeocoris ruber danicus (Fabricius)

1794 *Lygaeus danicus* Fabricius, Ent. Syst., iv, p. 181.
1800 *Lygaeus danicus* Wolff, Icones Cimic., i, p. 34, tab. 4, fig. 34.
1803 *Capsus danicus* Fabricius, Syst. Rhyng., p. 246.
1804 *Capsus danicus* Latreille, Hist. Nat. Crust. Ins. xii, p. 232.
1806 *Cimex Daniae* Turton, Syst. Nat., ii, p. 674.
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1890 *Deraeocoris segusinus* var. *danicus* Atkinson, Cat. Capsidae, p. 101.
1896 *Deraeocoris segusinus var. b. danicus* Reuter, Hem. Gymn. Eur., v, p. 33.
1909 *Deraeocoris ruber* var. *danicus* Oshanin, Verz. Palae. Hemip., i, p. 756.
1917 *Deraeocoris ruber* var. *danicus* Van Duzee, Cat. Hemip., p. 357.

♀. Head reddish, tylus and a mark extending from dorsal margin of eye to the collum, black; pronotum reddish, becoming black on the basal half but not covering the basal angles; scutellum and hemelytra reddish, clavus and rather broadly across apical end of corium blackish; cuneus red, the apical one-third black; legs and ventral surface similar to those of the typical form.

Plesiotype: ♀ July 12, New Haven, Connecticut (M. P. Zappe); author's collection. *Specimens examined*: MASSACHUSETTS,—♀ July 12, Beach Bluff; ♀ July 24, Marblehead (H. M. Parshley).

This variety represents the usual dark form of the female.

Deraeocoris ruber segusinus (Müller)

1766 *Cimex segusinus* Müller, Manip. Ins. Taur., p. 191.
1787 *Cimex tricolor* Fabricius, Mantissa Ins., ii, p. 306.
1794 *Lygaeus tricolor* Fabricius, Ent. Syst., iv, p. 181.
1800 *Lygaeus tricolor* Wolff, Icones Cimic., i, p. 35, tab. 4, fig. 35.

1803 *Capsus tricolor* Fabricius, Syst. Rhyng., p. 246.
1804 *Capsus tricolor* Panzer, Fauna Germ., fasic. xciii, fig. 20.
1804 *Capsus tricolor* Latreille, Hist. Nat. Crust. Ins., xii, p. 233.
1833 *Capsus tricolor* Dufour, Recher. Anat. Hemip., p. 176.
1835 *Capsus tricolor* Herrich-Schäeffer, Nomen. Ent., i, p. 51.
1837 *Capsus tricolor* Spinola, Essai sur les Hémip., p. 190.
1843 *Capsus tricolor* Meyer, Verz. Schw. Rhyn., p. 108.
1855 *Capsus (Deracocoris) tricolor* Kirschbaum, Jahr. ver. Nat. Herz. Nassau, x, p. 212; (Sep.) Rhyn. v. Wiesb., Caps., p. 52.
1860 *Capsus (Capsus) tricolor* Flor, Rhyng. Livl., i, p. 509.
1861 *Capsus capillaris var. c.* Fieber, Eur. Hemip., p. 266.
1875 *Deracocoris laniarius var. c.* Reuter, Rev. Crit. Caps., [ii], p. 73.—Acta Soc. Faun. Fl. Fenn., i, p. 89.
1890 *Deracocoris segusinus* var. *tricolor* Atkinson, Cat. Caps., p. 101.
1896 *Deracocoris segusinus var. c. tricolor* Reuter, Hem. Gymn. Eur., v, p. 33.
1909 *Deracocoris ruber* var. *segusinus* Oshanin, Verz. Palae. Hemip., i, p. 756.
1917 *Deracocoris ruber* var. *segusinus* Van Duzee, Cat. Hemip., p. 358.

♂. Black, front of head, base of corium and embolium, and basal half of cuneus, reddish; ventral surface of body black, ostiolar peritreme pale; legs colored as in the typical variety or only slightly darker.

Antennae: segment I, length .77 mm., black; II, 2.42 mm., slender on basal half, gradually thickened from middle toward apex, practically attaining the thickness of segment I, black, thickly clothed with short stiff black hairs, longest hairs scarcely attaining greatest thickness of segment; III, 1.03 mm., yellowish brown; IV, .65 mm., fusco-brownish.

Venter: black, shining, yellowish pubescent; genital claspers (fig. 43) distinctive of the species.

Plesiotype: ♂ June 29, White Plains, New York (C. E. Olsen); author's collection. *Specimens examined*: CONNECTICUT,—♂ July 21, New Haven (M. P. Zappe). MASSACHUSETTS,—♂ Aug. 16, Beach Bluff; ♂ July 24, Marblehead (H. M. Parshley). NEW YORK,—♂ June 20, ♂ July 10, Maspeth, Long Island (C. E. Olsen).

This variety represents the normal color phase of the male.

Deraeocoris ruber concolor (Reuter)

1896 *Deracocoris segusinus var. f. concolor* Reuter, Hem. Gymn. Eur., v, p. 34.
1909 *Deracocoris ruber* var. *concolor* Oshanin, Verz. Palae. Hemip., i, p. 756.
1917 *Deracocoris ruber* var. *concolor* Van Duzee, Cat. Hemip., p. 358.

The writer has not seen an example of the variety *concolor* Reuter.

All the varieties of *ruber* are merely melanic color forms, but as such, varietal names are useful for separating specimens into groups having the same general aspect. Each particular color phase is an in-

dex to the conditions of environment under which the bug developed.

The distribution of *ruber* in North America would indicate that the species had been introduced from Europe through the agencies of man. Uhler (1886) recorded *ruber* as occurring in the "N. St." The oldest specimen that the writer has seen was captured by Mr. Wm. T. Davis on Staten Island, ♂ July 10, 1888, taken on red raspberry. Mr. Davis also took several specimens on roses, July 14, 1912, in Brooklyn, New York. Their presence on rose bushes could doubtless be explained by the predaceous habits of the bugs in feeding on plant lice. Puton (1876) records *ruber* as predaceous,—"detruit les pucerons." Douglas (1895) gives some observations on the manner in which *ruber* fed upon a "pale green aphid."

SPECIES WHICH HAVE BEEN DESCRIBED OR PLACED IN THE GENUS DERAEOCORIS BUT BELONG TO OTHER GENERA

Lygus robustus (Uhler)

1895 *Camptobrochis robustus* Uhler, Hemip. Colo., p. 39.
1917 *Lygus robustus* Knight, Bul. 391, N. Y. (Cornell) Agr. Exp. Sta., p. 588.
1917 *Camptobrochys robustus* Van Duzee, Cat. Hemip., p. 354.

The writer (1917) placed this species as a Lygus and in the *pratensis* group. Among the material received for study from the National Museum, the writer has found one of the type specimens, labeled in Uhler's handwriting. It agrees in all respects with the original description and opportunity is here taken to designate it as the type. *Robustus* is most closely related to *Lygus humeralis* Knight, but is slightly larger and the anterior angles of the pronotum are less prominent.

To Uhler's description the writer desires to add the following observations on the type:

Length 6.3 mm. *Head*: width 1.26 mm., vertex .48 mm., length .63 mm., height at base .74 mm.; vertex nearly flat, carina prominent but apparently formed by the perpendicular front margin of the collum; front marked with six or seven oblique or nearly transverse, subcutaneous brownish black lines each side of the median line; rostrum (apex covered with glue) apparently reaching upon the hind coxae.

Pronotum: length 1.42 mm., width at base 2.45 mm., anterior angles 1.11 mm.; calli very slightly convex, basal margins distinctly impressed beneath the level of the pronotal disk, brownish black, more nearly black along the basal and outer margins; two brownish black stripes extending from basal margin of each callus to near middle of disk, median line paler than the general coloration of disk.

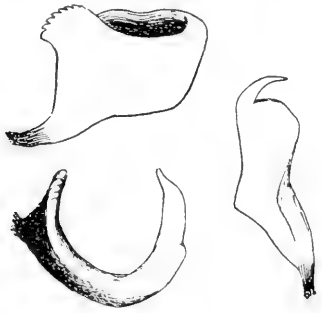

Fig. 44. *Lygus robustus*, male genital claspers.

Hemelytra: width 3.1 mm.; apex of marginal vein blackish, or "with black arrest at the end of the costal area" in the words of Uhler; lateral margin of corium pale translucent, the translucent area extending across base of cuneal fracture and around basal angle of cuneus to membrane; cuneus dark brown but distinctly paler along outer margin; membrane clear, or only slightly invaded with brownish from the veins, a dark mark paralleling the brachium at apex of larger areole similar to that found in *humeralis*.

Venter: olivaceo-testaceous, brownish black along basal margin of each segment but nearly

obsolete where a pale lateral stripe is formed, spiracles surrounded with pale and this in turn by blackish which occupies the basal half of each segment above the pale lateral line, the genital segment dark brownish black; genital claspers (fig. 44) distinctive of the species.

Lectotype: ♂ "Colo. 1690." [= July 10, 1894, on Grizzly Creek, Jackson County, Colorado, from *Artemisia tridentata*, alt. 9,500 ft. (C. F. Baker)]; Cat. No. 24172, U. S. N. M.

The lectotype represents the second specimen mentioned under the original description. The writer has specimens from Jemez Springs, New Mexico, which are slightly darker in color than the type but apparently not differing sufficiently even to be recognized as a color variety.

Lygus pratensis strigulatus (Walker)

1873 *Capsus strigulatus* Walker, Cat. Heterop., vi, p. 94.
1904 *Camptobrochis strigulatus* Distant, Ann. Mag. Nat. Hist., ser. 7, xiii, p. 111.
1917 *Camptobrochys strigulatus* Van Duzee, Cat. Hemip., p. 354.

In making a study of Walker's invariably miserable descriptions of Miridae, the writer was impressed by the color markings described for *Capsus strigulatus*. It just happens that in this case the color markings will apply only to certain color forms of *Lygus pratensis*, and one very dark form in particular with which the writer became familiar during a prolonged study of Lygus. Upon reading the description the writer turned immediately to this particular variety of *pratensis* and checked over and confirmed the few distinctive marks given for *strigulatus*. In this instance we must give Walker credit for describing a form which could not very well be confused with any species other than the varieties of *Lygus pratensis*. In fact this dark variety of *pratensis* may well be retained as a color variety and on a par with *oblineatus* Say. The writer has found variety *strigulatus* in New York and Minnesota, occurring most frequently on weeds during August and September.

Distant (1904), in making a study of Walker's types, places *strigulatus* in the genus Camptobrochis but this might be expected from any worker who had not made a close study of the genera involved. Recently the writer was agreeably surprised to find among the material from the National Museum a specimen labeled "*Capsus strigulatus* Walker" in Uhler's handwriting, representing the same variety of *pratensis* which the writer had recognized as *strigulatus* Walker!

Deraeocapsus new genus

General aspect suggestive of both Deraeocoris and Capsus but distinguished as follows: claws not cleft (fig. 2, H), pseudo-arolia absent; arolia slender, bristle-like and erect, nearly parallel but slightly converging at the apices; metatarsus distinctly thickened, about equal to twice the thickness of either of the following segments, when measured from the ventral aspect equal to the combined length of segments two and three; front tibiae with four or five heavy spines on ventral surface near apex, the arrangement of spines above and below the tibial comb also distinctive (Pl. IX, G-H); segment II of antennae strongly clavate apically; dorsum either distinctly hairy or nearly glabrous. Other characters as given in the specific descriptions by Mr. Van Duzee.

Genotype: *Deraeocoris ingens* Van Duzee (Univ. Calif. Publ., Tech. Bul., 1, p. 237).

KEY TO THE SPECIES OF DERAEOCAPSUS

Legs entirely black; pronotum and legs conspicuously hairy; segment II of antennae gradually thickened from base to near apex . . . . . *ingens* Van D.

Femora and basal half of tibiae reddish; not conspicuously hairy, pronotum practically glabrous; segment II of antennae strongly clavate on the apical half . . . . . *fraternus* Van D.

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LIST OF THE SPECIES OF DERAEOCORIS BY GROUPS