these localities there is enough intergrading in color to show the affinity of the different forms.

NOTE.—Varieties 4, 5 and 9 are in the cabinet of Mr. W. G. Wright, of San Bernardino, Cal. I think 4 and 5 were obtained by him from Mr. James Behrens, of San Francisco, and probably both were from Northern California.

THE NOCTUIDÆ OF NORTH AMERICA AND EUROPE COMPARED.

(*Fourth Paper.*)

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Tribe *Arzamini*.

The pale or yellow coloured species of *Gortyna*, the caterpillars being internal feeders, pupating, however, in the ground, prepare us for the *Nonagriini*. We have, however, in North America, a peculiar tribe which I have called *Arzamini*, and which I here interpolate. The caterpillar was first discovered by Prof. Comstock, in Florida Lakes, in the leaf-stalks of the pond lily. This was the larva of *A. vulnifica* var. *melanopyga*, and subsequently in the lake at Ithaca, the larva of the typical *vulnifica* was observed by the same distinguished entomologist. The larva is furnished with nine pairs of spiracles, and passes freely on the water from one leaf to another. Subsequently, the larva of *Sphida obliquata* was described by Prof. Kellicott. The moths of this tribe are related to the Nonagrians, but differ by the bluntly terminating abdomen of the female, recalling certain *Lachneinæ* in appearance. There are two genera: *Arzama*, with three distinct species (of which I owed specimens of *A. diffusa* to my excellent friend Mr. Moffat) in which the front is smooth, and *Sphida*, with the single species *obliquata*, in which the front is tuberculate. This appears not to be a variable or sexual character in the moths, as it may be in certain *Scarabeidæ*, but is in Lederer's opinion, with which I agree, of generic value. If we are not so to consider the tibial armature, or the conformation of the clypeus in the *Noctuidæ*, there remain few characters which we may use as generic. I am disposed to consider, then, *Copimamestra*, which differs from *Mamestra* by the tibial

claw and *Sphida*, which differs from *Arzama* by the clypeal tubercle, as independent genera on the strength of these single characters. The tribe *Arzamini* is not represented in Europe, and, beyond the *Dicopini*, is so far the first distinct structural departure in North America from the European types. While *Dicopis* and allies resemble the *Bombycoidi* or certain *Hadenini* in appearance, the *Arzamini* have a distinct and singular form, and, while their affinities evidently lie with the Nonagrians, their peculiar larval structure and habit clearly warrants our considering them as constituting a distinct group or tribe of the *Noctuidæ*. The resemblance in the female abdomen of the *Arzamini* to the Bombycid genus *Eriogaster*, and the unusual larval condition, lends interest to this tribe. May we not consider the *Arzamini* as an American survival of a very ancient form of the *Noctuidæ*?

Tribe *Nonagriini*.

This tribe differs from the *Hadenini* in the absence of body tuftings, and in the finer, smoother vestiture; only in a few genera is there a median thoracic ridge. In these characters *Gortyna* agrees with the *Hadenini*; the habit of the larva probably associates *Euthisanotia*, a tropical genus with foot-hold in Florida, with *Gortyna*. The present tribe is one of the most interesting of the family. The moths are pale or straw-coloured, some with a warmer, a little red or ochre tint, and the larvæ feed in reeds or grass. *Nonagria* has a stout, clypeal projection, and naked eyes; the larva lives in the stems of *Typha* and *Phragmites*, pupating in its burrow. We have eight North American species described; probably many more remain to be discovered, as the moths must be bred, and are not often captured. In Europe, seven are known. So far as known to me, our species are not like the European, or representative. We have an immense species, with the proportions of a small *Sphinx*, from Florida, my *N. permagna*. Our most usual species, perhaps, in the east, of moderate size, is my *subflava*. No species are known to me from California, but we must expect that they await discovery. These *Noctuidæ*, with boring larvæ, inhabiting swamps, must be an old form of the family, once, at least, of very general distribution. The European genus *Coenobia*, with one species, I have not found in North America, but I discovered a Western American genus *Fota*, with two small species, which, from its clypeal

structure and other characters, seems to belong here. I have described one American species of *Senta*, figured in the Buffalo Bulletin (1874); the figures on this plate are in some copies coloured. Of the European genus *Tapinostola*, two North American species are described, one only have I seen. The European genera *Meliana* and *Calamia*, with single species, are apparently wanting in North America; but we have a peculiar genus in *Ommatostola*, with lashed eyes. *Heliophila* Hüb. (= *Leucania* Ochs.) is, perhaps, the leading genus of the group; and, like *Apatela*, *Agrotis*, *Hadena* and *Mamestra*, contains identical and representative species. The eyes are hairy, the thorax smooth, the male antennæ impectinate, the body rather stout, the legs in some species thickly haired. Probably a resemblance of ornamentation between *Pseudolimacodes niveicostatus* and the European *Heliophila conigera*, led Guenée, although the eyes in the former are naked (but Guenée does not study this character), to describe our species, which I am disposed to refer even to a different sub-family, as belonging to *Leucania*. We have probably one identical species of *Heliophila* with Europe: *H. pallens*. Our *H. pseudargyria* seems to be allied to *lithargyria*, while we have a number of species resembling the European *obsoleta*, *straminea*, *comma*, *littoralis*, etc. No species have yet been found in North America at all resembling the European *evidens*, *conigera*, *vitellina*, *turca*. The well-known "Army Worm" *Heliophila unipuncta*, has been taken in England, and in the Madeira Islands, probably introduced from North America. Although single species may have now a wider range, I think we must conclude that the genus *Heliophila*, in North America, belongs to the European element, and is descended from a former common circumpolar fauna. These insects must be collected at light in the neighborhood of swamps and waters by which reeds and flags grow. In the stems of these we may find, in June and July, the grown caterpillars or pupæ of *Nonagria*. The European genera *Mycteroplus*, *Argyrospila*, *Mythimna*, with single or few species, are undescribed in our fauna. It seems probable that our Nonagrians are quite incompletely known, and that in North America, from which twenty-seven species of *Heliophila* are described, while Europe numbers thirty-two, many interesting discoveries await the entomologist in the present group. I have referred here the Californian genus *Zosteropoda*, from the shape of the wings and the tufted legs; and, as in other tribes,

North America is already credited with peculiar genera, with few species, clustering about the two principal genera, which are here : *Nonagria* and *Heliophila*.

Tribe *Scolecampini*.

The body is slender, smoothly haired ; the legs unarmed, thinly scaled, rather long ; the wings vary from rather broad to quite narrow ; the colors are mainly of the preceding group, and the caterpillar of *Scolecocampa* is said to burrow in wood. This tribe, with the *Arzamini*, is exclusively American, and may be considered, equally with that, to be an outgrowth of the Nonagrians. I refer here (see CAN. ENT. XV., 131) the genera *Scolecocampa*, *Eucalyptera*, *Amolita*, *Cilla*, *Doryodes*, *Phiprosopus*. Geyer's figure of *S. liburna* has the primaries shaded with red, a feature I have noticed in fresh Southern examples of the moth. Mr. Morrison seems to have had no notion of the affinities of his *Eucalyptera bipuncta* ; I referred the moth to *Scolecocampa*, the differences seeming only comparative, or of specific value. Since then I found a second Western form, and, although the differences are not very decided, I adopt the genus. In this tribe the ornamentation seems a modification of the usual Heliophilid type. The longitudinal medium stripe, the pale oblique shade to the still pointed primaries, the dots and dotted stigmata, varying in expression in the different genera, are Heliophilid features ; while the oblique and longer palpi, often smoky on the sides, the slender feet and linean body distinguish the tribe. *Doryodes* is described as a Geometrid by Guenée, and *Phiprosopus* (printed *Phyprosopus*, originally in error) is described, under characteristics which do not belong to the genus and were accidental in the type, equally as a Geometrid by Zeller, who subsequently acknowledged my prior and more correct reference of *P. callitrichoides* to the *Noctuidæ*. The chiloform appearance of most of the genera becomes almost lost in *Phiprosopus*, notwithstanding the narrow wings, while the labial palpi depart from the usual form ; these latter, and the peculiar color, remind one of certain exotic genera allied to *Calpe*, where I was at first disposed to locate the genus. When the immature stages are known, our present views may be modified. Always must our classifications be judged by their reasonableness in reference to the existing knowledge of the whole history of the insects.

Tribe *Caradrini*.

In this tribe, in which the body is still smoothly scaled, or with very slight tufts, the eyes naked, the tibiae unarmed, the two principal European genera are represented in North America. In *Caradrina*, twenty-eight European species are described, while but eleven have so far been discovered in North America. Of these, *Miranda* seems to be exceedingly near the rare and local European *lepigone*, while others have the European facies. The species of *Pyrophila* (= *Amphipyra*) are interesting as affording one identical species, *tragopogonis*, and one representative, *pyramidoides*. Whether the former is a survival or an importation is uncertain, I have been inclined to believe the latter is the case. The species of *Pyrophila* are large and so exceedingly like the flat species of *Agrotis*, that (when in the south away from my microscope) I mistook *tragopogonis*, communicated to me by Prof. Saunders as injurious to grape, for an *Agrotis*. The unarmed legs separate the present genus; but the habit is similar, as I have observed *pyramidoides* beneath the bark of decaying trees in the woods. Upon the loose bark being removed the moths endeavored to escape by running. Like cockroaches, the smooth greasy-looking vestiture, and the flat shape, evidently facilitate their movements in such places of concealment; I have observed species of *Agrotis saucia*, etc., in their company. The question of whether we should not bring in the *Agrotini*, between the *Caradrini* and the *Orthosini*, is yet, perhaps, an open one. No reasons are given by Lederer for not following the arrangement of older authors; but it is better to conform in such cases to Lederer's example, as it is followed in Europe, and since my main object has been always to bring the two faunæ under the same artificial system, so that they can be compared, the differences and resemblances taken note of. In the present tribe the derivation of one part of our fauna is very clear. The European *pyramided*, and our *pyramidoides*, are descended from one stock. We have apparently failed to take over the other large and showy species of *Pyrophila* found in Europe, as I have seen nothing like them in any North American collection. In the west is found my *Fotella notalis*, a moth apparently allied to *Acosmetia*; this latter, with the other European Caradrinid genera, I have not recognized in North America. I am uncertain as to whether *Adipsophanes* and *Crambodes* should not be included in this tribe; the former genus includes my *miscellus* and *terminellus*, the latter Guenée's *talidiformis*.