DIFFERENTIAL CHARACTERS USED IN SEPARATING NYMPHS OF THE GRASSHOPPER SPECIES MELANOPLUS DIFFERENTIALIS AND M. BIVITTATUS

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Up to the present, no work has been published relative to the description of the immature stages of the two grasshoppers referred to in the title. As a consequence, no keys have been devised by means of which the nymphs in question can be separated. To the economic entomologist it is highly important that he know, at the outset of his control campaign, the species of insect with which he must contend. The group of characters about to be discussed can be used, with a possible very few exceptions, to separate accurately the nymphs of these locusts.

Structurally the nymphs of the two species are so nearly alike that so far as is known at present their separation cannot be based on morphological characters. For immediate identification, then, we must base our conclusions on color characteristics.

In a general way it may be stated that the nymphs of **M. differentialis** are darker than those of **M. bivittatus,** although there are occasional exceptions. **M. differentialis** is usually considerably more heavily mottled than **M. bivittatus,** which occasionally is almost entirely free from dark markings, except on the wing pads and hind femora.

The yellowish background color is, as a rule, noticeably brighter in the case of **M. bivittatus.** Quite often the nymphs of **M. bivittatus** beyond the second or third instar are green marked with black rather than of the usual yellowish ground color with fuscous markings. The writer has never observed a nymph of **M. differentialis** with a green background color. Green nymphs, then, if belonging to either of these two species, are **M. bivittatus.** On the other hand, quite a percentage of specimens of **M. differentialis** exhibits melanism in varying degrees, from only slightly darker than usual to almost entirely black. However, even in the darkest individuals the markings of the hind femora are typical of the species as compared to **M. bivittatus,** and the light areas

usually stand out very plainly against the dark background. A specimen of **M. bivittatus** exhibiting melanism has never been observed by the writer.

In both species there is a yellowish lateral thoracic stripe, wider at the anterior end, which extends from the front to the hind margin of the pronotum. In **M. bivittatus** the stripe stands out clearly, bordered sharply above by brownish black to black. The lower margin of the stripe blends into the brownish black mottling of the lateral lobes of the pronotum. In some individuals the blackish markings are lacking. The stripe is usually narrower in the case of **M. differentialis** and is often slightly mottled instead of clear yellowish. The upper margin is not so clearly defined as in **M. bivittatus.** Occasionally the stripe does not reach the hind margin of the pronotum in **M. differentialis.**

The median carina of the thorax stands out definitely in both cases; however, in **M. bivittatus** the area on either side of the carina is considerably less mottled than in the case in **M. differentialis,** in which the mottling persists to the base of the keel. Consequently there is a much wider yellowish dorsal stripe in **M. bivittatus.**

Of the various color characteristics discussed those of the hind femora are the most important from our point of view. The outer face of the femur has a "herring-bone" weave or "chevrons" appearance. In this work these structures will be referred to as the "chevrons". Dorsally the femur is divided by a longitudinal keel into two regions which have been called the outer and inner faces of the upperparts. It is on the markings of the chevrons and the outer face of the upperparts that the separation of the two species is largely based.

Melanoplus bivittatus has chevrons with the upper half to three-fourths solid fuscous to black with the possible exception of the extreme upper ends of the proximal two or three chevrons and fine lines separating the first five or six. The outer face of the upperparts is either clear yellowish to green or lightly sprinkled with fine brownish dots. Rarely three very faint darker areas are present on the outer face. These darker areas are very distinct over the inner face.

The lower part of the chevrons is yellowish or yellowish-white to green and the exceptions mentioned are of the same color.

Melanoplus differentialis usually has the fuscous color of the chevrons broken by alternating light areas. The lower part of the chevrons, as in **bivittatus,** is usually clear yellowish to yellowish white, as are the light areas of the dorsal halves. The outer face of the upperparts has three distinct dark areas separated by lighter areas which correspond in position with the light areas of the chevrons, thus giving somewhat of a transversely banded appearance to the femur. This condition is typical of **M. differentialis,** although occasionally a specimen is found in which the chevron markings are practically identical with those of **M. bivittatus,** at least so much so that they might be confused with regards to this one character. However, in these cases the dark areas of the outer face of the upperparts always come to the rescue by showing up very plainly, so that there need be no question as to the species to which the specimen belongs.

From a study of the characters discussed, based on two generations of grasshoppers, the following key has been developed:

A Key for the Separation of Grasshopper Nymphs of the Species Melanoplus differentialis and M. bivittatus

A. "Chevrons" of femur with upperparts running together to form solid fuscous, longitudinal stripe. Upper ends of proximal "chevrons" or fine lines separating them may be yellowish to green.....usually **bivittatus.**

B. Upper outer parts of femora, above "chevrons", of clear yellowish to green or possibly showing three very faint darker areas.....**bivittatus.**

B.B. Upper outer parts of femora, above "chevrons", definitely showing three darker areas alternating with light areas.....**differentialis**

A.A. "Chevrons" of femur with upperparts not running together but broken by light areas. In later stages chevrons may extend clear across outer face of femur; dark and light areas alternating.....**differentialis.**