

shading from light to dark brown; wings hyaline, subcosta ends in R_1 about two-fifths of the distance between the humeral cross-vein and base of radial sector; cubitus forks about under distal end of subcosta, not detached; anterior veins much stronger than posterior; R_{4-5} strongly arched in proximal half, distal half being only gently curved; length of rhomboidal cell varies from 1.25 to 1.75 its width; base of radial sector and R_{2-3} slender.

Female. Resembles the male; genitalia yellow tipped with dark brown.

Described from a series of one male and four females taken during May and June in the vicinity of Vancouver.

THE LIFE HISTORY OF APATETICUS CROCATUS Uhl. (HEMIPTERA)

By W. Downes.

The species which forms the subject of the present paper is a large pentatomid bug which is fairly common in the neighbourhood of Victoria and a somewhat familiar object during the late summer and fall. It belongs to the class popularly called "stink bugs," a well-earned name by the way, and is one of the largest members of the Heteroptera in our local fauna.

Although, in common with the rest of the pentatomids, it has an unevitable reputation owing to the possession of repugnatorial glands which secrete the objectionable odour familiar to all who have attempted to handle them, nevertheless the species we are considering has good points which make it worthy of our interest and protection, for it is of considerable economic value, its food consisting to a very large extent of caterpillars, especially tent caterpillars, and larvae of the oak looper (*Ellopiia somniaria*), so that it may be classed among our useful insects.

Wherever caterpillars are numerous, these bugs will be found. Many of them take up their abode within the webs made by the tent caterpillars, where they find a plentiful food supply within easy reach. Others are found on the oak trees infested with "looper" caterpillars, but they are not entirely dependent on animal food by any means. In fact, a certain amount of vegetable food is essential for them, and during the first instar the little nymphs are entirely phytophagous and possibly the species may be able to subsist without much animal food.

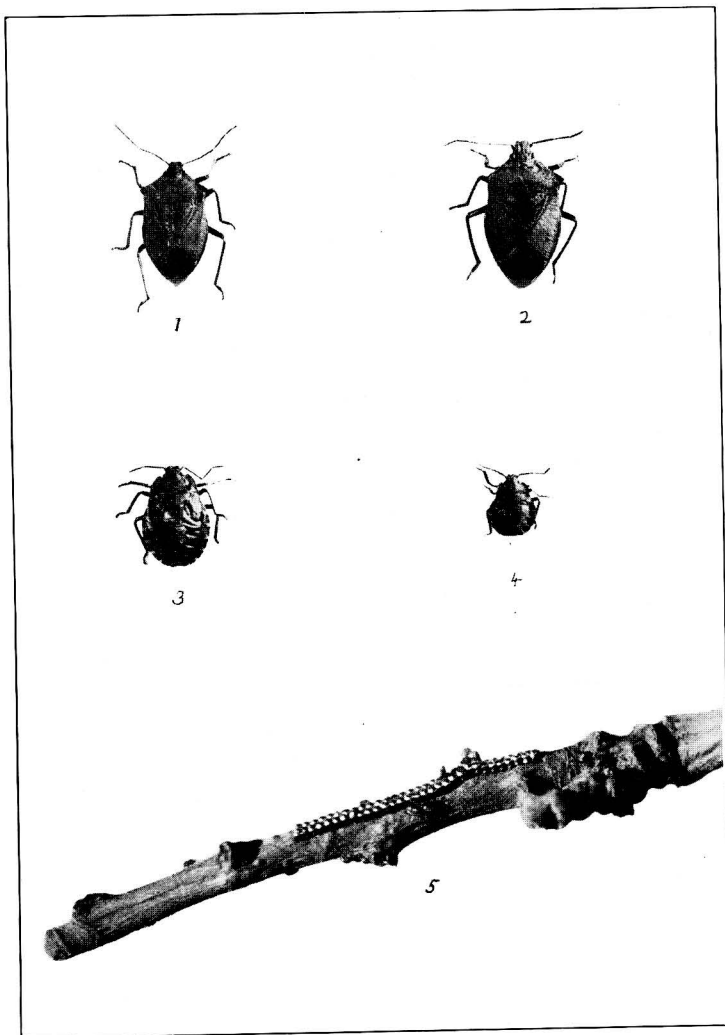
The Egg. The egg is cylindrical with slightly convex sides, its height being about one-third greater than its diameter, somewhat barrel-shaped in fact. The top and bottom are convex and the cap, or lid, is surrounded by a fringe of short incurving spines. The eggs are smooth and shiny and in colour are brownish black with irregular oval areas of dull white on the sides. Around the rim is a narrow white band from which arises the chaplet of spines of the same colour, tipped with black.

The eggs stand upright in a double row, usually on the upper side of a twig and may be sixty or seventy in number. One female that I watched laid her eggs on the upright iron standard of my garden gate. The time occupied in depositing one egg varied, but was usually about four minutes. Having deposited an egg on the right, the female moved slightly upward and laid another on the left, touching, but slightly in advance of, the first. The next egg would be deposited on the right side, touching the first egg and slightly in advance of the second, and so on alternately on the right and left until the double line was complete, each egg standing in the angle formed by the junction of the eggs in the opposite row. At first the eggs are white, but darken within a few minutes. The majority are probably laid in September and October. Those that I have observed were laid on October 25th. These hatched on May 19th following. Another lot collected in the field hatched on April 21st, and a third lot from an oak tree hatched on June 7th. The little bugs when newly emerged from the egg are entirely red but harden within half an hour; the legs, head and thorax becoming black, while the abdomen remains a deep red, bordered by a row of black spots and with a row of large quadrangular black markings on the central dorsal line.

The Nymphal Stages. During the first instar the nymphs are gregarious and usually remain clustered together, a habit common to many species of pentatomids, and so far as I have observed, are entirely vegetable feeders during this period. After the first moult, however, they show a tendency to wander and commence to feed on other insects when opportunity is given. The gregarious habit is abandoned during the later moults.

On April 21st, 1919, the first lot of nymphs kept under observation hatched from a batch of eggs laid on an apple twig. These were divided into two lots, one of which was kept at my residence while the other remained at the laboratory. Petri dishes with covers were used for breeding cages at first, but were soon abandoned in favour of fruit jars covered with muslin, as the moisture condensed in large drops in the petri dishes and drowned many of the little nymphs.

The lot kept at the laboratory progressed at first much more rapidly than those at the house. They were supplied with sprays of young pear leaves, on which they were occasionally observed to feed. The first moult occurred in this lot on April 30th, but those at the house did not moult until May 6th. The average temperature at the laboratory was several degrees higher than at the house, which partly accounts for the more rapid growth of the nymphs. On May 10th, five nymphs of this lot were observed to be feeding on a bud-moth larva. A nest of tent caterpillars was obtained and placed in the jar, and shortly after several of the nymphs were seen to be attacking these. It was found, however, that many nymphs were lost by getting entangled in the webs, also,



Apateticus crocatus Uhl.

- Fig. 1. Adult male.
- Fig. 2. Adult female.
- Fig. 3. Nymph, fifth stage.
- Fig. 4. Nymph, fourth stage.
- Fig. 5. Eggs on twig, young nymphs emerging.

that at this stage of their growth they cannot live extensively on animal food but require a constant supply of fresh green leaves. They seem to require a certain amount of moisture and were seen sucking at drops that condensed on the glass of the breeding jar. The experiment of feeding them on syrup, of white sugar and water, was tried, and this they took readily. The second moult of those kept at the house was noted on May 20th, the third on June 2nd, the fourth on June 19th, and the fifth on July . th. Four lots were kept under observation at different periods and the average length of the instars was found to be thirteen days under artificial conditions, the fourth and fifth instars being the longest. I was able to observe the change from the last nymphal stage to adult. The nymph in each case rested head downwards hanging from a twig. Ecdysis was complete in ten minutes and as soon as free the adult reversed its position. At first the adults are pale salmon pink and do not harden completely for nearly two days. The final moult was observed on July 8th and on the 10th the bugs were observed to be sufficiently hardened and attacking tent caterpillars. During the fifth instar the nymphs refused animal food, seeming to prefer plant juices. Young branches of wild rose were supplied, the bugs invariably sucking from the leaf petioles or midribs. Other plant food besides briar rose was tried, namely, pear, apple, oak and willow, but rose seemed to be preferred. Of the four broods kept under observation the last reached adult condition on August 18th.

Feeding Habits. It was interesting to observe the extreme timidity and caution which marked the attitude of the bugs when attacking their prey. Not being possessed of any weapon to aid them, such as the powerful grasping forelegs of those species that are solely predatory, they are forced to await a propitious time for attack. On scenting game the beak is immediately extended and the bug advances towards its quarry. Usually weak and sickly caterpillars are selected or one that is in such a position as to be unable to escape. When within half an inch or so the rate of advance is cautiously slackened and the progress of the extended beak towards the caterpillar becomes so slow as to be scarcely perceptible. Should the caterpillar make the slightest movement, the bug immediately retreats, advancing again and again until at last from sheer weariness the caterpillar permits the beak to be inserted. Once this occurs there is no escape. The barbed tips of the maxillae give the bug a hold that is not readily shaken off, and despite wriggling and squirming the beak turns in the wound without withdrawing. Not until the caterpillar is sucked dry does the bug withdraw its beak, and it may retain its hold for as long as twelve hours. It is only when pressed by hunger that they show any boldness. Some that had been without food for nearly a fortnight were supplied with larvae of the poplar sawfly (*Platycampus victoria* MacGill). These they accepted readily, following them up with beak extended and

antennae quivering, and when near their prey, would make a short rush forward, stabbing the larvae with their beaks.

Mating was first observed on July 22nd, but probably owing to an insufficient food supply, I failed to get the females to oviposit.

DESCRIPTION OF LIFE STAGES

Egg. Height, 1.07 mm.; width, .80 mm.; width of cap, .56 mm.; shape, oval cylindrical; smooth, glossy; base flattened; sides and cap slightly convex; general appearance, brownish-black in color with large irregular areas of white on the sides, cap black, surrounded by a narrow white circle, from the outer edge of which arises a row of incurving white spines, sixteen to nineteen in number. Eggs are laid in a double row firmly attached to one another and to their support.

Nymph: first instar. *Body* broadly ovate, narrowing anteriorly, broadly rounded posteriorly. Average length, 1.76 mm. Average width, 1.60 mm. *Head*, somewhat rounded in front, nearly twice as broad as long, posterior margin rounded; width, including eyes, .72 mm. *Prothorax* narrow, curving anteriorly, twice as wide as head, excluding the eyes, shortest at median dorsal line, from thence widening slightly to lateral margins. *Mesothorax* one-fifth shorter and slightly wider than prothorax, curving anteriorly. *Abdomen*, rounded, dorsum convex, nearly one half as long as wide. *Antennae*, stout, medium length, slightly pubescent, terminal joint the longest, thickened and tapering at proximal and distal extremities. Length, 1.35 mm.; 1st segment, .15 mm.; 2nd segment, .36 mm.; 3rd segment, .30 mm.; 4th segment, .53 mm. *Legs* medium length, strong; hind tibia, .46 mm. *Color*, head, antennae, prothorax, mesothorax and legs black, eyes red, abdomen crimson, conspicuously marked on the median dorsal line with four quadrangular black spots; lateral margins spotted with four quadrangular black markings; ventral surface of abdomen red, lateral margins spotted with black.

Second Instar. *Body* longer, broadly pyriform, length 1.90 mm.—2.6 mm. *Head*, quadrate, anterior outline slightly curved, posterior margin curved, tylus distinct, not shorter than juga, eyes prominent. Width, including eyes, .845 mm. *Prothorax*, one-third wider than head, curving anteriorly. Anterior and posterior margins nearly parallel, divergent at sides, lateral margins explanate. *Mesothorax* of nearly equal length and width to prothorax, curving anteriorly, shorter at lateral margins, anterior margin slightly curved, posterior margin broadly angled. *Metathorax* very short at median dorsal line, from thence widening to lateral margins, width scarcely exceeding mesothorax. *Abdomen* rounded, dorsum convex, venter slightly convex. *Antennae*, more slender, pubescent; length, 1.93 mm.; 1st segment, .16 mm.; 2nd segment, .6 mm.; 3rd segment, .5 mm.; 4th segment, .6 mm. *Legs*, strong, tarsi furnished with a few short hairs, claws strong, recurved; length of hind tibia, .96 mm. *Color*, dorsal surface of head and thorax black with a greenish metallic sheen, eyes red to brownish-black, under surface of thorax, legs and rostrum piceous; *antennae* brownish-black; *abdomen* crimson, with four quadrangular greenish-black spots on median dorsal line, lateral margins spotted as before, the spots being relatively smaller than in the first instar; ventral surface of abdomen crimson, lateral margins spotted with black.

Third Instar. Shape of body similar to previous instar, but abdomen more rotund. Average length, 3.86 mm. *Head*, sub-quadrate, eyes prominent, anterior margins of juga and tylus rounded, juga slightly longer than tylus, vertex rough; width, including eyes, 1.6 mm. *Prothorax*, two and one half times wider than

head, rugose, anterior and posterior margins parallel, anterior margin straight behind head, curving sharply forward behind the eyes; lateral margins explanate, rounded, converging to head, minutely serrulate; posterior margin straight, extremities curving slightly caudad. *Mesothorax*, slightly wider than prothorax at median dorsal line, thence narrowing to lateral margins, widest at posterior angles, central posterior margin broadly angled, projecting caudad. *Metathorax* slightly narrower than mesothorax and one half as long, constricted in centre, surface smooth. *Abdomen*, nearly round, dorsum strongly convex, venter slightly convex. *Antennae*, pubescent; length, 2.4 mm.; 1st segment, .2 mm.; 2nd segment, .86 mm.; 3rd segment, .6 mm.; 4th segment, .6 mm. *Legs*, strong, tibiae and tarsi slightly hairy, femora with a few short hairs. Length of hind tibia, 1.03 mm. *Color*, dorsal surface as before, ventral surface of thorax crimson, pleurae dusky, eyes and antennae black.

Fourth Instar. Shape similar to previous instar; length, 7.5 mm.; greatest width, 4.43 mm. *Head*, sub-quadrate, flattened, eyes prominent, juga rounded in front, longer than tylus, margins bordered by a small but distinct flange, surface roughened. *Prothorax*, twice as wide as head, rugose, callosities apparent, anterior and posterior margins nearly parallel, anterior margin curving sharply forward behind eyes, lateral margins explanate, minutely toothed, posterior margin slightly procurved, posterior angles projecting slightly caudad. *Mesothorax*, wider than prothorax and slightly longer at median line, surface rugose, posterior margin angled at centre, lateral lobes short, projecting caudad as far as second abdominal segment. *Metathorax*, three-fourths as wide as mesothorax, very short at centre, from thence widening and recurving on each side of median dorsal line. *Abdomen*, broad, rounded, dorsum convex, venter slightly convex. *Antennae*, pubescent, distal segment slightly thicker than 3rd; length, 4.2 mm.; 1st segment, .43 mm.; 2nd segment, 1.56 mm.; 3rd segment, 1.1 mm.; 4th segment, 1.1 mm. *Legs*, tibiae and tarsi hairy, femora with a few short hairs; length of hind tibia, 2.3 mm. *Color*, the same as before, some individuals showing coppery metallic tints on dorsal surface of head and thorax.

Fifth Instar. Body more ovate, abdomen less tumid, wing pads developed; length, 10 to 12 mm.; width, 7 to 8 mm. *Head*, as in previous stages but juga relatively longer, lateral margins curved. *Prothorax*, equal in length to head and twice as wide; anterior margin curved, lateral margins converging anteriorly, explanate and irregularly toothed, posterior margin slightly procurved, lateral posterior angles acute, projecting caudad, surface rugose, callosities large. *Mesothorax* one-third longer than prothorax, wing pads extending beyond second abdominal segment; central portion of posterior margin angled and extending caudad beyond metathorax, surface minutely punctate. *Metathorax*, very short, narrow, one half as wide as mesothorax, apparent only between the angles formed by the wing pads. *Abdomen* oval, dorsal and ventral surfaces convex, the larger spots on median dorsal line each with an elliptical rugose callus; inner portion of spots on lateral margins bifurcate. *Antennae*, pubescent, terminal segment scarcely thicker than the third; length, 5.53 mm.; 1st segment, .5 mm.; 2nd segment, 2.3 mm.; 3rd segment, 1.43 mm.; 4th segment, 1.3 mm. *Legs*, strong as in previous instar; hind tibia, 3.4 mm. *Color*, variable, dorsal surface of head and thorax and spots on abdomen coppery metallic green with golden sheen in some individuals, others with thorax mottled with red; dorsal surface of abdomen crimson, ventral surface pale red, pleurae dusky, legs and antennae black with metallic green reflections.

Adult. Uhler's original description (1) is as follows:

"*Podisus crocatus*, New sp.—Broad, suboval, more robust than *P. cynicus* Say., and with blunter and more callous humeral angles. Color dull orange,

brighter beneath, coarsely, deeply and unevenly punctate with dark green. Head sub-quadrate, longer than wide, margined with dark green, often with two dark, short stripes on the basal raised lines, and with a dark streak on the middle of the tylus, reliefs between the eyes strongly defined, lateral lobes somewhat longer than the tylus, more finely punctate than the vertex, their outer angles a little rounded and marked with dark green. Underside of head polished, sparsely and finely punctate in separated patches or lines, the under submargin of the lateral lobes closely and deeply punctate; rostrum reaching to just behind the middle coxae, the second joint reaching to the posterior margin of the anterior coxae; antennae dusky rufous, darker on middle of last three segments. Pronotum wide, deeply, coarsely punctate, mostly in transverse wavy lines, and punctures partly confluent on the disk, depression at base of forward lobe marked with a transverse series of indented and discolored spots, the posterior lobe more or less darkened with obscure green, the humeral angles irregularly triangular, callous at tip, a little shorter and less acute than in *P. cynicus* Say., the extremity often dark green, and charged with four wrinkles, anterior part of lateral margin coarsely granulate-serrate. Pleural pieces coarsely, remotely, deeply punctate, excepting the area around the ostiolar canal. Legs luteous, sparsely punctate, the femora more or less pointed with rufous, and wrinkled. Scutellum more finely punctate, clouded with green, the middle line smooth and very sparsely punctate. Clavus narrow, dark, luteous, greenish at base, punctate in lines; corium finely and remotely punctate with green, the costal area more coarsely so, and more spotted, membrane longer than the venter, pale bronze, finely granulated, the veins a little darker. Venter coarsely, remotely, unevenly punctate and rugose on the sides, with a broad, smooth, middle line, almost impunctate; tergum purplish black, dull, the connexivum orange, punctate with red, the sutures of the segments broadly marked with a quadrate, black-green, densely punctate spot across the entire width of the connexivum; ventral spur long, acute in the male, blunter in the female. Length to end of venter 13 to 17 mm. Width across humeral angles 8 to 10 mm.

"This species is common in Western Oregon and Washington Territories. It occurs also on Vancouver Island, and extends south into California. The third joint of the antennae is much shorter than the preceding or following ones, the second is longest, and nearly twice as long as the third. The species is very variable in the degree and amount of dark marking on the several parts of the upper surface."

The color of both sexes varies considerably, but in general the ground color is pale brown or fawn, more or less suffused or mottled with dark green with a metallic lustre. In some individuals the ground-color is almost obscured, while others are uniformly pale with an entire absence of green excepting the brilliant metallic spots on the connexivum. In such individuals the tergum is crimson; in dark specimens it is black.

The vaginal plate is triangular, and the characteristics of the female genitalia resemble those of its near ally *bracteatus*. The most noticeable structural character differentiating *crocatus* from *bracteatus* is the shape of the lateral pronotal spines, which are short and blunt, while those of *bracteatus* are decidedly more acute and projecting. In a series of eighteen specimens of *crocatus* before me I find this feature constant. In *cynicus* the vaginal plate is quadrangular, which clearly distinguishes it from both *crocatus* and *bracteatus*.

Bracteatus has been recorded as occurring on Vancouver Island (2), but during four years' collecting I have not as yet come across any specimens that could be referred to this species.

I wish to express my acknowledgments to Dr. H. M. Parshley who has assisted me by sending specimens of *Apateticus bracteatus* for comparison and a copy of Uhler's original description.

REFERENCES

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THE GENUS ARGYNNIS IN BRITISH COLUMBIA

By E. H. Blackmore, F.E.S.

The genus *Argynnis*, or, as they are commonly called, Fritillaries or Silver-spots, belong to the family *Nymphalidae* or brush-footed butterflies, so called on account of the first pair of legs being aborted, and folded in front of them, thus being of no use for walking purposes.

This genus is one of the largest in this family; it is well represented in Europe, and is found in Asia, China and Japan. Several species are found in Australia, and two or three species in Africa, but it is in North America that it has found its greatest development. They are found on high mountains up to the timber limit, and at lower elevations down to sea-level, but they are, generally speaking, a mountain-loving group.

The species composing this genus are of moderate or large size, and are distinguished by their bright tawny or fulvous colour, with well defined black markings, which consist of waved transverse lines and rounded or triangular markings on the outer borders.

A great many species so closely approximate each other that great difficulty is experienced in separating them satisfactorily; most of the eastern species have had their life histories carefully worked out, so that not much difficulty is now experienced in determining them, but it is our western forms that have caused the most trouble to students of this genus. Many different causes are responsible for this confusion; in some cases the limits of variation are not very well known; and in others, species intergrade with each other so that in a long series it is hard to tell where one species leaves off and another one begins. Mis-identifications and confusion of species by some of the older authors led to a great deal of trouble in this respect. In some cases descriptions have not been detailed enough to allow of a definite placing of species, and have been so vaguely worded that they will allow two or three different forms to fit it in a more or less satisfactory manner.

Fortunately, for present day systematists, Dr. Wm. Barnes some years ago—1913, to be exact—sent Dr. J. McDunnough to Europe for