

may be considered almost perennial in habit, where its own disabilities as a food-collector, on account of local inertia and the total absence of tentacles, were supplemented by the life-sustaining currents induced by its more active neighbours. These conditions are near Philadelphia furnished by *Urnatella gracilis*, Leidy, and *Pottsiella erecta*, Kræpelin (*Paludicella erecta*, Potts). I regret to be obliged to add that I am not aware that either of these has been collected in any other neighbourhood.

Philadelphia,
August 19th, 1897.

XXII.—A Revision of the Butterflies of the Genus *Ixias*.

By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c.

THE present genus is confined to the Old World, being found throughout India and Ceylon, Burmah, Siam, China, and south-eastwards to the Celebes and Timor.

Ixias in general aspect resembles certain groups of the genus *Teracolus*, but is readily distinguishable by the neuration, the first two branches of the subcostal vein in the primaries being emitted wider apart, the upper radial emitted from the subcostal vein well beyond the end of the cell (expressed in the recently adopted phraseology this would stand as "veins 6, 7, and 8 stalked"). In the secondaries the discocellulars are much more oblique than in *Teracolus*.

The seasonal variation of *Ixias* differs somewhat from that of *Teracolus*, nor is it quite consistent in its character throughout the genus. As a rule the wet form has heavy borders to the wings on the upper surface and scarcely any markings on the under surface (often only a black dot at the end of the discoidal cells and a spot at the external angle of the primaries), but in some of the species there appears to be no wet phase of marking and coloration, and in others the wet-season form shows dark spots on the under surface occupying the exact positions of the ocelloid markings characteristic of the dry season.

Group 1. (Type *I. venilia*.)

Apical two thirds of primaries above veined with black; under surface always showing dry-season markings; the only probable seasonal difference consisting in the width of the border of the secondaries on the upper surface; it is not,

however, certain that this difference in the present group has a seasonal significance, though it is certain that it has no specific value, as hitherto supposed.

1. *Ixias Reinwardtii*.

Thestias Reinwardtii, Vollenhoven, Tijds. Ent. iii. p. 125 (1860);
Monog. Pier. p. 50, pl. vi. fig. 1 (1860).

Lombok, Flores, and Laraut, near Timor. B. M.

We have nine examples in the Museum series and three in the Hewitson collection; one female from the Godman and Salvin collection is unusually black on the upper surface, the white markings on the apical area being very much reduced and those towards the apex obliterated.

2. *Ixias pulchrior*, sp. n.

♂. Allied to the preceding, but the ash-grey suffusion at the base clearer and more restricted, the disk (beyond the orange patch) sulphur-tinted; the discal interrupted stripe terminating above the third median branch, the outer border and blackened veins narrower.

The female differs more markedly, the white patches beyond the cell of primaries being washed with orange and widened and extended so as to be continuous with the white area below the cell; the border of the secondaries is also similar to that of the male, not widened and bordered with grey scaling as in *I. Reinwardtii*. The under surface of both sexes differs from the latter chiefly in being less marked with black, the general pattern and coloration being very similar.

Expanse of wings, ♂ 58–61, ♀ 64 millim.

Bali Island (*Wallace*). B. M.

There are four examples in the Museum series and two in the Hewitson collection.

3. *Ixias Piepersi*.

Thestias Piepersi, Snellen, Tijds. Ent. xxi. p. 31, pl. ii. figs. 1, 2 (1878).

Celebes.

Not in the Museum series. It is a curious insect, combining characters of *I. Reinwardtii* and *I. venilia*, so that it is difficult to know exactly where to place it in a linear series.

4. *Ixias Kühni*.

Ixias Kühni, Röber, Tijds. Ent. xxxiv. p. 287, xxxv. pl. iv. figs. 3, 4 (1892).

Wetter. B. M.

Three males bearing a manuscript name of Staudinger's were received in the Godman and Salvin series.

5. *Ixias venilia*.

♂. *Pieris venilia*, Godart, Enc. Méth. ix. p. 121 (part.) (1819); Lucas, Lep. Exot. pl. xxxvi. fig. 1 (1835).

♂ ♀, Java (*Horsfield*). B. M.

One of M. Godart's typical examples was identical with Wallace's *I. venatrix*.

6. *Ixias Vollenhovii*.

Thestias Vollenhovii, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 393 (1867).

Thestias venatrix, Wallace, *l. c.*

Pieris venilia, Godart, Enc. Méth. ix. p. 121 (part.) (1819).

Timor, Dili, Semão, Java. B. M.

Eleven examples in the Museum series and four in the Hewitson collection. *I. venatrix* appears to be the dry-season form and is linked to typical *I. Vollenhovii* by an example received in the Godman and Salvin series. Wallace wrongly gave Moulmein as the locality of his *I. venatrix*, supposing that "E. Indies" indicated one of the specimens so labelled from Archdeacon Clerk's collection; had either he or Capt. Watson looked up the register number this error would have been discovered and saved much perplexity.

7. *Ixias insignis*.

Ixias insignis, Butler, Cist. Ent. ii. p. 431, pl. viii. fig. 1 (1879).

♂, Formosa. Type B. M.

8. *Ixias balice*.

Thestias balice, Boisduval, Sp. Gén. Lép. i. p. 593 (1836).

♂, Java. B. M.

Group 2. (Type *I. flavipennis*.)

The ground-colour of all the wings above golden yellow.

9. *Ixias flavipennis*.

Ixias flavipennis, Grose-Smith, in Forbes's Nat. Wand. p. 275 (1885).

Ixias pyritis, Weymer, Stett. ent. Zeit. 1886, pl. i. fig. 4; 1887, p. 13.

Sumatra (*Major Fawcett*), two males. B. M.

Group 3. (Type *I. pyrene*.)

This is the largest and most perplexing group in the genus, and it is possible that I may not have sufficiently reduced the number of named species; this, however, is, I think, preferable to reckless sinking of forms which are locally constant under one heading. In the late Capt. E. Y. Watson's review of the Indian species it is difficult to comprehend his meaning; he regards the whole of the species of the present group as one; but he says:—" *I. pyrene* is very subject to both climatic and seasonal variation, and many forms have been named. Of these some are fairly distinct, and the males can be compared as below."

Now it seems to me that to discriminate between "a distinct climatic form" and "a species" we must have a universally accepted definition of what a species is, which is impossible: therefore, to my mind, if a thing is distinct it ought not to receive the same name as that from which it is admitted to be distinct, for to give the same name to two distinct things is to stultify the very object aimed at in nomenclature.

In the present group the wet-season forms are usually almost unmarked below and the dry forms heavily speckled and ocellated, whilst the outer borders on the upper surface are, as a rule, considerably broader in the wet than in the dry forms, sometimes disappearing entirely from the secondaries of the latter.

10. *Ixias rhexia*.

♂. *Papilio rhexia*, Fabricius, Syst. Ent. p. 476 (1775); ♀. Butler, Cat. Fabr. p. 216, pl. i. fig. 5 (1870).

♀. *Papilio pirithous*, Fabricius, t. c. p. 483 (1775).

♀. *Ixias familiaris*, Butler, Trans. Ent. Soc. 1874, p. 432.

Ranges from Tibet through N.E. India into Burmah. Twenty-nine examples. B. M.

There are five examples in the Hewitson collection, one of which is a remarkable albino male, having a white instead of orange patch on the upper surface of the primaries.

11. *Ixias evippe*.

Papilio evippe, Drury, Ill. Exot. Ent. i. pl. v. fig. 2 (1773).

Ixias anexibia, Hübner, Verz. bek. Schmett. p. 95 (1816).

S.E. China and the Island of Hainan. B. M.

The Museum series consists of thirteen examples, and there is one specimen in the Hewitson collection. *I. anexibia* is the dry form and *I. evippe* the wet.

This and the preceding species have long been confounded,

but the Chinese and Indo-Burmese forms differ somewhat. Taken collectively *I. evippe* runs somewhat smaller than *I. rhexia*, never attaining the expanse of wing which some of the wet-season examples of that species show; the form of the wings in *I. evippe* is also rounder and more regular, the orange belt on the primaries is distinctly broader and extends further back into the discoidal cell, its front edge is diffused instead of sharply outlined; the seasonal forms also differ less in size and in the width of the border on the upper surface of the secondaries than in *I. rhexia*.

12. *Ixias undatus*.

Ixias undatus, Butler, P. Z. S. 1871, p. 252, pl. xix. fig. 4.

Borneo. Ten specimens (all males). B. M.

There is also one male in the Hewitson collection. It is curious that the female does not come to hand.

13. *Ixias latifasciatus*.

Ixias latifasciatus (part.), Butler, P. Z. S. 1871, p. 252, ♂.

Tenasserim, Burmah. B. M.

We possess ten examples of this species, of which seven belong to the dry-season form and exhibit the heavily black striated under surface which seems peculiar to this species. The female which I figured is that sex of *I. verna* (a white-winged species), which fact probably confused the late Capt. Watson, who regarded the present species as a form of *I. pyrene* rather than *I. rhexia* (to which it is much more nearly related); also, not having taken special notes of the type specimens, he erroneously identified the wet form of the species as typical, and (not possessing the dry form of the male) naturally concluded that the species was based upon an extreme seasonal form of *I. pyrene*. The seasonal forms of *I. latifasciatus* hardly differ on the upper surface; the border varies slightly in width in examples both of the wet and dry forms, one of our wet-season males showing a rather narrower border to the secondaries than any of our dry-season examples. Apart from the ground-colour of the wings this species is not at all unlike *I. verna*.

14. *Ixias Birdi*.

♂. *Ixias Birdi*, Distant, Ann. & Mag. Nat. Hist. ser. 5, vol. xii. p. 351 (1883); Rhop. Mal. pl. xxvi. fig. 4 (1882-86).

♂. Allied to the preceding species, slightly smaller, with the orange belt on the primaries sharply defined and more

golden in colour; the black border of the secondaries considerably narrower (about the width of that in *I. cingalensis*, but slightly wider towards anal angle); under surface clear lemon-yellow, marked as in the typical *dry-season* form of *I. latifasciatus*.

Expanse of wings 59 millim.

Dry form, ♂, Perak (*Townsend*); from G. and S. coll.

Although we only have one example of this species, I am quite satisfied of its distinctness. The type was a wet-season form.

15. *Ixias cingalensis*.

Ixias cingalensis, Moore, Lep. Ceylon, i. p. 126, pl. i. figs. 2, 2 a (1881).

Ceylon. B. M.

We have thirteen examples of this species, four of which are wet-season males and the remainder dry-season specimens of both sexes. The Hewitson collection contains four examples.

Capt. Watson extended the range of this species over Southern India and regarded *I. ihoda* = *I. kausala* as the dry form of the species; but the wet and dry forms of *I. cingalensis* are absolutely identical on the upper surface, nor does *I. kausala* invariably possess the character upon which Capt. Watson defined *I. cingalensis*, for he says:—"It can be separated at once from all other forms of yellow *Ixias* by the greater extent of the basal yellow of the fore wing, which spreads into the upper median interspace." In our specimens of *I. kausala* the "basal yellow" extends more, less, or not at all into the upper median interspace.

I. cingalensis can be picked out at sight from a crowd of nearly allied forms, but the distinction given above is useless as a guide; its chief peculiarity is the narrowness and angularity of the orange belt across the primaries combined with the sharply defined and perfectly straight inner edge of this belt from subcostal vein to first median branch.

16. *Ixias frequens*.

Ixias frequens, Butler, P. Z. S. 1880, p. 150, pl. xv. figs. 6, 7.

Ixias alana, Swinhoe, Ann. & Mag. Nat. Hist. ser. 6, vol. v. p. 357 (1890).

India generally. B. M.

Thirty-three examples, representing wet-, intermediate-, and dry-season forms; the males and sometimes the females of the dry form are smaller and with much narrower (though always well-marked) border to the upper surface of the secondaries.

17. *Ixias moulmeinensis*.

Ixias moulmeinensis, Moore, P. Z. S. 1878, p. 837.

Ixias meipona, Grose-Smith, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 296 (1887); Rhop. Exot., *Pieris* II., *Ixias*, figs. 4, 5 (1888).

Burmah. B. M.

We have thirty-three examples, representing wet-, intermediate-, and dry-season forms; the wet form is *I. meipona* and the dry *I. moulmeinensis*. Doubtless this is the Burmese representative of the Indian *I. frequens*; as a whole it is somewhat smaller (though individuals of the same size belonging to both species may be selected from a long series), the orange belt of the primaries is more golden, more deeply incised at the end of the cell, and, in the female, where it becomes an orange or yellow band, it is more narrowly bordered behind with black; the border of the secondaries is much narrower, almost disappearing in the extreme dry form, which is also much more heavily and clearly marked with ocelloid spots on the under surface than in *I. frequens*.

18. *Ixias dharmsalæ*.

Ixias dharmsalæ, Butler, P. Z. S. 1880, p. 150, pl. xv. figs. 8, 9.

Ixias ganduca, Moore, Journ. As. Soc. Beng. lii. p. 44 (1884).

Ixias colaba, Swinhoe, P. Z. S. 1885, p. 142, pl. ix. fig. 6.

India, from Darjiling to the Western Provinces and southwards to the Neilgherries.

Twenty-eight specimens are in the collection and one in the Hewitson cabinet. *I. colaba* is the wet-season form, *I. dharmsalæ* a dry form (probably occurring at the commencement of the dry season), and *I. ganduca* the extreme dry form.

This butterfly can be distinguished from *I. frequens* by its narrower, internally notched, and more or less macular hind-wing outer border, which also tapers less towards anal angle, and in the possession of an additional form of female (wholly black and white above). I am doubtful whether it will be possible to keep it distinct from *I. pirenassa* (of which no wet form answering to the type is known to me).

19. *Ixias satadra*.

Ixias satadra, Moore, Ann. & Mag. Nat. Hist. vol. xx. p. 50 (1877);

Waterhouse, Aid, ii. pl. cxxviii. fig. 1 (1883).

Ixias Watti, Butler, P. Z. S. 1880, p. 151, pl. xv. fig. 1.

Ixias pygmæa, Moore, P. Z. S. 1882, p. 254, pl. xii. fig. 1.

Northern India from Sikhim to Campbellpore. Fourteen examples. B. M.

The type of the species is an intermediate-season form, but so little marked below that it probably occurs at the end of the wet season. We also have two dry forms, the first occurring probably at the commencement of the dry season and the other (which is more extreme in its seasonal characters) a little later; the latter is *I. pygmæa*. This species is characterized by the very irregular and somewhat narrow orange belt on the primaries of the male, the macular and rapidly tapering form of the blackish border to the secondaries; the dry-season female varies very little in colour, the subapical belt on the primaries being sulphur-yellow, sometimes feebly washed with orange.

20. *Ixias pirenassa*.

Thestias pirenassa, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 395, pl. ix. fig. 4, ♂ (1867).

Ixias kausala, Moore, Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 49 (1877).

Ixias jhoda, Swinhoe, P. Z. S. 1885, p. 142, pl. ix. figs. 3, 4.

Western India southwards to Depalpur. Twenty-eight specimens. B. M.

It is quite possible that this may only be represented by dry phases of *I. dharmalæ*; *I. pirenassa*, *I. jhoda*, and *I. kausala* representing three grades, of which the last-mentioned is the most pronounced dry form. We have four intermediate-seasonal specimens, one of which, in the pattern of the upper surface, links typical *I. pirenassa* to *I. jhoda*, whilst the three others show the upper-surface pattern of *I. jhoda* and the size of *I. kausala*.

The only objection to sinking *I. dharmalæ* under *I. pirenassa* is that we should have to admit great instability in the seasonal modification of the hind-wing border (some of the examples obtained just after the rains showing a drier character of upper surface than those of the dry season), and we should also be compelled to recognize five grades of dryness in the under-surface pattern. On the whole I prefer to await further evidence before assuming that the forms of the *I. pyrene* section of my group 3 are more variable than those of the *I. evippe* section.

21. *Ixias sesia*.

Papilio sesia, Fabricius, Gen. Ins. p. 257 (1777); Donovan, Ins. China, pl. xxxi. fig. 2 (1798).

Burmah. Nineteen examples. B. M.

All the specimens that I have seen, including four in the

Hewitson cabinet, have a more or less dry-season character of under surface, but the character of the upper surface varies from wet to dry, as in the seasonal forms of the *I. marianne* group. The female invariably has the inner edging of the orange belt on the primaries widely interrupted in the centre, and the driest examples of the males have this blackish border reduced in the centre to a mere dusted line; the black discocellular spot on the primaries is almost invariably isolated from this black edging, owing to the continuation of the orange belt to a short distance inside of it. The late Capt. Watson regarded this last as a character of almost specific importance, but it is certainly not quite constant and therefore is of no great value.

It is, of course, just possible that *I. sesia* may be based upon additional variations of the dry form of *I. moulmeinensis*; but then we should have more difficulties to contend with than in the case of *I. pirenassa* as representing phases of *I. dharmalæ*. I think it far more likely that, as in *I. marianne*, several of these allies of *I. pyrene* invariably show dry-season characters on the under surface which are merely intensified in the dry season, whereas the bordering of the secondaries above varies in width seasonally.

22. *Ixias pyrene*.

Papilio pyrene, Linn. Mus. Lud. Utr. p. 241 (1764); Cramer, Pap. Exot. ii. pl. cxxii. figs. A, B (1779).

♀. *Papilio ænippe*, Cramer, Pap. Exot. ii. pl. cv. C, D (1779).

China. Twelve examples. B. M.

I have very little doubt that Cramer's figures of *P. pyrene* (A and B) represent the wet-season form, though showing dry-season characters on the underside. The species is nearly related to *I. sesia* and possibly not distinct from it, as Donovan's illustration of *I. sesia* is probably taken from a Chinese example; the dry form of China, however, which is typical *I. pyrene*, is decidedly larger than that of Burmah. The locality "America" given by Fabricius affords no clue to the real habitat of his type.

Group 4. (Type *I. Ludekingii*.)

Chiefly differs from the preceding group in the nearly white wings of both sexes. The seasonal differences are quite normal, only the dry form having the wings ocellated below.

23. *Ixias andamana*.

Ixias andamana, Moore, P. Z. S. 1877, p. 590.

Ixias lena, Swinhoe, Ann. & Mag. Nat. Hist. ser. 6, vol. v. p. 357 (1890).

Andamans. Twenty-two examples. B. M.

I. andamana was based upon the intermediate and *I. lena* on the dry form.

24. *Ixias Ludekingii*.

Thestias Ludekingii, Vollenhoven, Monog. Pier. p. 49, pl. v. fig. 6 (1865); Tijd. Ent. iii. p. 126 (1869).

Sumatra. ♂ from G. and S. coll. B. M.

Our single example belongs to the wet-season form, but the type was a dry form. We have what I believe to be the male intermediate form from Salanga.

25. *Ixias pallida*.

Ixias pallida, Moore, P. Z. S. 1878, p. 837.

Ixias citrina, Moore, l. c.

Tenasserim. Seven examples. B. M.

I. pallida was based upon a wet-season male, *I. citrina* upon a dry-season male.

26. *Ixias verna*.

Ixias verna, Druce, P. Z. S. 1874, p. 108, pl. xvi. figs. 5, 6.

Ixias latifasciatus ♀, Butler, P. Z. S. 1871, p. 252, pl. xix. fig. 3.

Burmah, High Island, Mergui. B. M.

We have fifteen examples, seven of which (including the types of the species) were presented by Messrs. Godman and Salvin. *I. latifasciatus* was figured from an intermediate female, *I. verna* was described from a dry-season pair. A male from Mergui in the collection may perhaps be a curious aberration of this species.

Group 5. (Type *I. marianne*.)

I am quite satisfied that the late Capt. Watson was correct in his view of the species of this group; all the seasonal forms show ocellated markings on the under surface, but they become emphasized in the dry season, whilst the black belt across the primaries on the upper surface and the black border to the secondaries are reduced.

27. *Ixias marianne*.

Papilio marianne, Cramer, Pap. Exot. iii. pl. ccxvii. C-E (1782).

Ixias bebryce, Hübner, Verz. bek. Schmett. p. 95 (1816).

Ixias agnivera, Moore, Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 50 (1877).

Ixias depalpura, Butler, P. Z. S. 1883, p. 153, pl. xxiv. figs. 6, 7.

Ixias meridionalis, Swinhoe, P. Z. S. 1885, p. 140, pl. ix. fig. 5.

Ixias cumballa, Swinhoe, t. c. p. 141, pl. ix. figs. 13, 14.

We have twenty-five examples of the wet-season form (*I. cumballa*), thirteen of the intermediate form (*I. marianne*), twenty-three of the early dry form (*I. meridionalis*), and sixteen of the late dry form (*I. agnivera*=*depalpura*)—seventy-seven examples in all.

28. *Ixias nola*.

Ixias nola, Swinhoe, P. Z. S. 1889, p. 399.

Mahableshtar. Twelve examples. B. M.

The seasonal forms are all represented in our series; a pair of the wet and a pair of the dry form are equally labelled as types.

XXIII.—On a Precaudal Vertebra of *Ichthyosaurus australis*,
McCoy. By R. ETHERIDGE, Jun., Curator*.

THE subject of this paper is the imperfect vertebra of a large Ichthyopterigian, referable, I believe, to *Ichthyosaurus australis*, McCoy †. The original was brought under my notice by the Rev. M. Kirkpatrick, of Bega, N. S. Wales, who obtained it from Marathon, Central Queensland. With his permission a cast was taken for the Australian Museum collection. As Sir F. McCoy's description was very brief, an extended notice of one of the middle trunk, or anterior precaudal, vertebræ may be acceptable to Australian investigators.

The specimen is the centrum of a large vertebra measuring 5 inches in its vertical and transverse diameters, and rivals in size those of the gigantic *I. campylodon*, Carter, from the European Chalk, the vertebra figured ‡ by the late Sir Richard Owen measuring only 4 inches high. Our example is devoid of the neural spine, neurapophyses, and pleurapophyses, but

* From the 'Records of the Australian Museum,' vol. iii. no. 3 pp. 66-68.

† Trans. Roy. Soc. Vict. viii. 1868, p. 41.

‡ Owen, Mon. Foss. Reptilia Cret. Formation, p. 79, pl. xxii.



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