

THE GENUS *PONTIA* FABRICIUS (LEPIDOPTERA: PIERIDAE) IN THE KUMAON HIMALAYA

(With one text figure)

Key words: Lepidoptera, Pieridae, *Pontia*, Himalaya, faunal drift

The range of *Pontia daplidice* Linnaeus and *Pontia glauconome* Klug is extended eastward to the Kumaon Himalaya. An uncertain record of *Pontia chloridice* Huebner from the same area is noted. The possibility of this faunal drift being a recent phenomenon is examined.

TAXONOMY

In the Indian sub-region, three species are generally assigned to the genus *Pontia* Fabricius. These are *daplidice* Linnaeus, *chloridice* Huebner and *glauconome* Klug. *Pontia* is sometimes treated as a sub-genus of *Pieris* Schrank (Evans 1932a, Wynter-Blyth 1957). Some authors (Watson & Whalley 1983, Daccordi *et al.* 1988) include *callidice* Huebner in *Pontia*, although Varshney (1993) treats *callidice* as the type species of the genus *Synchloe* Huebner. For the purpose of this paper, I have followed Varshney (op. cit.), since this is the most recent work on the subject.

GEOGRAPHY

The Kumaon Himalaya consists of a section of the Himalayan range, from the low sub-montane tract known as the Bhabar to the trans-Himalayan region, extending between 28 degrees 44 minutes to 30 degrees 49 minutes North and 78 degrees 44 minutes to 81 degrees 01 minutes East. Broadly speaking, the area consists of three parallel mountain ranges.

The outermost range rises steeply above the plains to more than 2000 m above msl, reaching 2600 m in some peaks near Nainital. Rainfall is heaviest on the southern slopes of this range, between 1981 cm and 3048 cm annually. This area receives the major part of its annual precipitation during the southwest monsoon from June to September. Most of the sites mentioned in this paper are situated in this range, i.e. Nainital, Bhimtal, Sattal, Naukuchiatal, Ramgarh, Gethia in Kumaon and Mussoorie in Garhwal. Some of the precipitation is in the form of winter snow in Nainital, Ramgarh and Mussoorie, but this is not usual in the other places mentioned.

North of this lies the middle range in which Almora, Panuanaula and Binsar are situated. This range is generally lower than the outer range, although it rises in places to nearly 2600 m above msl. The middle range receives less precipitation and is altogether drier than the outer range. As in the outer range, there is snowfall above 1600 m in winter and all the three places mentioned above experience snowfall.

Further north lies the main Himalayan range, which is too well known to warrant description here. It receives most of its precipitation in the form of snow above 4000 m. Between 1400m and 4000 m, the precipitation is in the form of

rain in summer and snow in winter, while below 1200 m, snow is not usual even in winter.

North of this range lies the trans-Himalayan rain shadow area. Members of the *Pontia* genus have been recorded from the rain shadow of Ladakh and Himachal Pradesh, but not of Uttaranchal.

DISTRIBUTION

Concerning the distribution of the genus *Pontia*, Varshney (1993) noted that it is a Palaearctic sub element, centred in Pakistan and northwest India, extending to Iran, the Middle East and Asia Minor. Within the Indian sub region, he gave Baluchistan, Chitral and Punjab in Pakistan and Ladakh in Jammu and Kashmir as the area from where these butterflies have been recorded.

Watson & Whalley (1983), however, state that *Pontia* has the most species in Europe and temperate Asia, with a few known from North Africa. They go on to caution about catalogues of the genus where there are many names, the majority of which is sub-species or forms of *daplidice*.

The known range of *P. daplidice* is N. Africa, southern Europe to India and Japan (Lewis 1973). Watson & Whalley (op. cit.) omit N. Africa, but include Britain. Within the Indian sub-region, it has been recorded from Baluchistan to Chitral and Murree in Pakistan (Evans 1932a). Peile (1937) added Peshawar in Pakistan and Wynter-Blyth (1957) added Kashmir to Shipki in the erstwhile state of Bashahr in present day Himachal Pradesh to this range (Fig. 1).

I have found *P. daplidice* to be a common butterfly in Kumaon. It occurs from the outermost range of the foothills to the main Himalayan range. In the foothills, it occurs between 1200 m and 2400 m elevation and has been recorded from Sattal (approx. 1200 m), Bhimtal valley (1400 – 1500 m), Nainital (1800 – 2400 m), Ramgarh (1800 – 2200 m) and Gethia (approx. 1400 m) in Nainital district and Binsar (2400 m), Almora (1600 – 1800 m) and between Bhuteshwar and Panuanaula (approx. 1800 m) in Almora district.

In the main range, I found it in the Dhaulti Ganga Valley north of Joshimath in Chamoli district, Garhwal at 1800 m to 2200 m and there is a record from Khati village (2500 m) on the route to the Pindari glacier in Bageshwar district, northern Kumaon.

The present records extend the known range of this species by about 300 km south-southeast of Shipki, which was its previous limit, to Naukuchiatal and Khati. The present eastern limit of this butterfly's range in the area is uncertain, but so far I have no records from Pithoragarh district on the border with Nepal. It should be mentioned that there have been no recent surveys in that district.

The recorded range of *chloridice* is from S. Europe to Iran and Mongolia as well as N. America (Watson & Whalley op. cit.). Lewis (op. cit.) added Tibet, southwest China and east Siberia to this range. Within the Indian sub-region, it has been recorded from Baluchistan, Chitral and Ladakh according to Evans (1932a) and Peile (op. cit.). Wynter-Blyth (op. cit.) did not mention this taxon, since its known distribution was outside the area covered by his book.

Hannington (1910) recorded this species from Kumaon at an elevation of 3650 m in August and September, and noted that it was rare. It is not clear why Evans (op. cit.) and Peile (op. cit.) subsequently overlooked this record, even though Peile included Hannington's list among the appendices to his book. The matter is discussed further on.

The third member of the genus, *P. glauconome*, is known from east Africa, Arabia, Iran, Baluchistan, Punjab and Chitral in Pakistan according to Evans (op. cit., 1932b), Peile (op. cit.) and Wynter-Blyth (op. cit.). The latter added Karachi, while Peile added Iraq to this range.

Roonwal *et al.* (1956) reported a specimen of *glauconome* from Mussoorie in Garhwal, in the collection of the Forest Research Institute, Dehra Dun. In addition, I have an extreme dry season form of *glauconome* recorded at Bhimtal on May 1, 1976, with a forewing length of 20 mm. This record extends the known range by nearly 200 km east-southeast of Mussoorie, its previous eastern limit.

On the basis of the abovementioned records, the range of all three members of the genus from the India sub-region is extended to the Kumaon Himalaya. The occurrence of *chloridice* is a little uncertain, since we have only Hannington's (1910) report to rely on, but the records for *daplidice* and *glauconome* are backed by specimens.

HABITS AND HABITAT

The following account deals only with *daplidice*. According to Peile (1937), it is on the wing in April, and during September and October near Peshawar and Miriamshah in Pakistan. He found it rare.

In Kumaon, it is multivoltine in the outer ranges, on the wing from March to July and in September and October, with stragglers appearing as late as December. In the main range, it appears to be uni- or bivoltine, since it has been found between May and early August, but not before or after. Given that the seasons are better defined in the main range than in the outer ranges, and the cold season more severe, it is unlikely that this insect is as prolific there as it is in the outer ranges. Of interest is the fact that it is on the wing even in July and the first few days of August, at the height of the southwest monsoon, in the outer range.

On the wing, it is often very similar to *Artogeia canidia* Sparrman (Pieridae), which occurs at the same places and times as *daplidice*. Generally, however, the flight is rapid, rather swifter than *canidia* and nearer the ground. It is fond of fields, sunny paths and ridges. I have never found it within shady forests. Rather, it keeps to the open parts and will rise above the level of the trees to cross the shady parts, although it generally keeps low in the open.

Both sexes settle frequently on the low growing flowers of Compositae (*Senecio* Linn., *Erigeron bellidioides* (Buch. Ham., ex D. Don) Benth. Ex C.B. Clarke), as well as to bask with wings closed or partially open on low plants or on the ground. I have not met them visiting water or damp mud.

BREEDING

This account deals only with *daplidice*. The larvae of the nominate subspecies are known to feed on species of Cruciferae (Friedrich 1983). The subspecies *moorei* Roeber does not appear to have been actually bred in India until now.

Females of *daplidice* were observed ovipositing on immature seeds and leaves of *Lepidium virginicum* Linn. (Cruciferae). The plants with the ova were placed in a breeding box where the larvae emerged within a week, but did not survive. Subsequently, second instar and third instar larvae were located on plants of the same species and successfully bred through. One individual pupated on June 3, 1998 and emerged on June 8, 1998. Others pupated for more or less the same period, but it is not possible to give exact dates since they were kept together. The larval stage probably lasts a fortnight or three weeks, giving a time frame of a brood a month or every five weeks during summer in the outer ranges. This means that in the outer ranges, there is a more or less continuous succession of broods during spring and summer.

The hostplant, *Lepidium virginicum* (Virginia Peppergrass; Bird's Pepper; Virginia Pepperweed) is a native of North America and is widespread from the Atlantic coast to the Rocky Mountains, West Indies, Mexico, Central and South America. It has been introduced to India most probably as part of the U.S. grain shipments during the 1950s and 1960s. Maheshwari & Paul (1973) reported its spread to the Netarhat Plateau, Bihar.

Unfortunately, there is no record of when this weed reached Kumaon. Gupta (1968) did not mention it. Gupta (1968) mentioned *Lepidium ruderale* Linn., which Maheshwari & Paul (1973) note is often misapplied to *L. virginicum* in Indian herbaria. Since *L. ruderale* is also cultivated, it is unlikely that Gupta (op. cit.) misidentified it.

Today, *L. virginicum* is naturalized in different parts of India and is frequently abundant in degraded areas, roadside swards, vacant lots, fallow fields and neglected lawns. In Kumaon, it germinates in early spring and dies down by September.

SEASONAL VARIATION

Peile (1937) noted that *daplidice* varies much with the season. Individuals recorded in Kumaon display a little seasonal variation, in that the apical dark area on the forewing *recto* is relatively lighter and the individuals large in the spring brood(s), i.e. from March to May. Individuals recorded in June are small and heavily marked on the forewing *recto*, while the post-monsoon brood from September and October is of the same size as the spring brood and heavily marked, the white sub-marginal spots on the forewing *recto* often greatly reduced, with some absent. The green markings on the *verso* surface do not vary much, either individually or seasonally.

The individual of *glauconome* was recorded in May, the height of the dry season. It is a typical dry season form of the species, with the green markings on the *verso* surface almost obsolete, but the veins on the hindwing *verso* prominently yellow.

DISCUSSION

Pontia daplidice is a known migrant, individuals crossing to Britain from the European mainland (Watson & Whalley 1983), from low elevation to high elevation in erstwhile Czechoslovakia (Kudrna 1974a) and from the Asian mainland to Japan (Kudrna 1974b).

Mackinnon & de Niceville (1897) did not find *daplidice* in Mussoorie or the Dun valley and Hannyngton (1910) did not find it in Kumaon although both these lists are very nearly complete. R.C. Busher, who collected butterflies around Nainital and compiled an unpublished list of local butterflies in 1918 (ms in author's possession), including interesting species in the Vanrennen collection, did not include *daplidice*. Nor does it find mention in notes compiled by my father, the late Fred Smetacek Sr., from the Nainital, Bhimtal and Naukuchiatal area during 1949 and 1950.

It first appears in notes compiled in 1961, with what appears to be the first pair recorded from Sattal (1200 m) near Bhimtal on April 21, 1961, by my father. The notes state "Not rare at Sattal and Bhimtal in late April and May 1961. Rarer in 1962. Also flies during September and October. Also captured at Bhimtal on August 27, 1964." (Victor Smetacek's notes).

It appears probable that, rather than having been overlooked, this species colonized the outer ranges of Kumaon between 1950 and 1961.

Of interest is the record of *P. daplidice* by Atkinson (1882) from the main Himalayan range between the Tons and Sarda rives, i.e. the present state of Uttaranchal. He stated that his list is based, with few exceptions, on actual specimens collected by him or others. It is unclear why Hannyngton (op. cit.) and other authors overlooked this record, unless the specimen was subsequently identified as *chloridice*, which is similar.

This would explain the presence of *daplidice* and absence of *chloridice* from Atkinson's list and the presence of *chloridice* and absence of *daplidice* from Hannyngton's list. Whatever the truth of these surmises, they are to do with the main Himalayan range and do not alter the fact that the colonization of the middle and outer ranges of the Himalaya in Kumaon by *daplidice* appears to be recent.

Added to this, Atkinson's (1882) list is not impeccable, and among numerous misidentifications may be cited *Rhpicera satricus* Doub. for what was probably *Rhpicera moorei* Butler; *Vanessa urticae* Linn. for *Aglais cashmirensis* Koll. and "*Argynnis*" *rudra* Moore which does not occur west of Meghalaya.

During the winter of 1998-1999, the rains were very meager. As a result, spring was very dry and many annuals failed to germinate. Among these was *Lepidium virginicum* which appeared only in irrigated valleys, but not at all in the waste ground and roadside swards all over Nainital district.

The population of *Pontia daplidice* tumbled more or less correspondingly after the first brood, so that in late May I saw none and in June only a single freshly emerged female. Normally, in the c.25 km between Bhimtal and Gethia or Nainital, it was possible to see at least a dozen individuals during the season.

In the meantime, the population of *Artogeia canidia*, another *Lepidium virginicum* feeder, was not affected, so *canidia* probably feeds on something else in addition to *L. virginicum*. This is not unusual, as *canidia* has been known from Kumaon since butterfly records began.

Varshney (1993) recorded seeds of *Reseda* (Resedaceae), *Turritis*, *Sisymbrium*, *Sinapis* and *Alyssum* (all Cruciferae) as larval host plants of the genus, evidently non-Indian records. Gupta (1968) recorded species of *Turritis* Linn. and *Arabidopsis* Schur. from Nainital. However, *daplidice* does not appear to feed on these plants here, judging by its population decline corresponding with the decline of *Lepidium virginicum*. It is an observed fact that the population of *daplidice* declined soon after the decline of *L. virginicum* and subsequently both taxa recovered.

In July 1999, although the southwest monsoon was in progress, *Lepidium virginicum* had not germinated in areas where it was common the previous year, and it was only to be found on a limited scale in irrigated areas. In 2000, the inevitable re-colonisation of degraded areas by this weed was followed by a corresponding increase in the *daplidice* population, so that by 2002, *daplidice* was as common as it was prior to 1999.

Pontia daplidice moorei Roeber is distinguished from the nominate subspecies by being a very large form. The population of *daplidice* from Kumaon is assigned to *moorei* on the basis of the relatively large size of the majority of individuals and the contiguous distribution of the two populations.

Peile (1937) collected a female with a wing expanse of 65 mm at Peshawar (Pakistan), now in the collection of the Natural History Museum, London, U.K. Hence, he gave the expanse of this subspecies as 45 to 65 mm; while Wynter-Blyth (1957), whose work was published twenty years later than Peile's, followed Evans (op. cit.) in assigning 45 to 50 mm. Specimens from Kumaon have a wing expanse up to 58 mm. One specimen taken in June has an expanse of 42 mm. Therefore, the wing expanse of this subspecies ought to be from 42 to 65 mm.

The records of *P. glauconome* from Mussoorie and Bhimtal are quite certainly stragglers from further west, but it is uncertain how much further west. The question is, is there a breeding population of *glauconome* in the plains of western India, or are the two specimens recorded from the known populations now in Pakistan? Both possibilities are equally likely, since this is a genus of strong flyers and migrants. Similarly, the breeding or migrant status of *P. chloridice* in the Kumaon and Garhwal Himalaya requires clarification.

The present records of *glauconome* are of interest since it has a rather restricted distribution in this area compared with other members of the genus. It occurs from east Africa to Chitral and Karachi in Pakistan. Given that it is capable of traveling as far east as Kumaon, its comparatively restricted distribution may be attributed to its inability to breed in areas which are not completely favourable. In other words, it is not as resilient a species as the other members of the genus, although individuals are capable of traveling a considerable distance.

Unlike the other two members of the genus, *glauconome* is a low elevation butterfly that has colonized the warm, dry and low areas of Pakistan and other parts of its range, but seems to be unable to tolerate wetter regions such as

Kumaon. *P. daplidice*, on the other hand, has given a new dimension to generic preferences by colonizing and thriving in the heavy rainfall areas of Kumaon, which are well within the subtropical monsoon zone.

Almost all the Lepidoptera that appear to have colonized or migrated to Kumaon recently belong to the Indo-Malayan fauna (Smetacek 1994, 1995, 2001, unpublished data). The colonization of the outer ranges of Kumaon by *daplidice* is of interest, since it is generally considered a Palaearctic taxon. This extension goes against the apparent trend, where the Central and Western Himalaya are getting warmer and wetter (Myers 1985) and consequently more conducive to colonization by Indo-Malayan fauna (Smetacek 1994).

Wynter-Blyth (1957) noted that *daplidice* is primarily an inhabitant of the high inner hills, common at high altitude. In my experience, it is common at moderate elevation, i.e. between 1200 m to 2500 m, and less so above. As a matter of fact, I have never found it above 3000 m in Kumaon or Garhwal. Also, I have found it to be commoner in the outer range than in the main Himalayan range. In the main range, I have found it in open river valleys near cultivation, rather than on hillsides or ridges at high elevation. Being a strong flier and quite a migrant, it might occasionally be found at high elevation like *Catopsilia pomona* Fabricius (Smetacek 1993), but it seems generally that above the tree line it is merely a straggler.

CONCLUSION

From the above account, it is evident that the distribution of two members of the genus *Pontia*, i.e. *daplidice* and *glauconome*, has extended to the Kumaon Himalaya, the former as a colonist and the latter as a straggling migrant. The colonization of this area by *daplidice* appears to be quite recent, probably in the middle of the 20th century. It seems that the major factor behind its increased range is the spread of the North American plant, *Lepidium virginicum*, which was introduced to India, probably in grain shipments in the post-Independence period.

P. daplidice has been bred on this plant in Kumaon, and in 1999, populations of *daplidice* in the area fell sharply at the same time as this plant failed to germinate in places where it was common, mainly due to meager winter rains. It is interesting that the lack of a suitable larval host plant rather than a climatic factor appears to have restricted the distribution of *daplidice* to the Palaearctic Region. The self-introduction of a suitable host plant has resulted in the colonization by *daplidice* of Kumaon, which is known as the mixing zone between the Palaearctic and Indo-Malayan faunas. The possibility of it extending its distribution further east in the coming years cannot be ruled out.

In the present context of global warming, the extension of range of a typically Palaearctic genus into the transitional zone represented by Kumaon is unusual.

ACKNOWLEDGEMENTS

I am grateful to Professor Y.P.S. Pangtey of Thakur D.S.B. Constituent College, Nainital, for kindly identifying the larval host plant of *P. daplidice*, as well as to the editor and anonymous referees for their valuable suggestions.

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(March 2000)

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