Research Notes

NOTES ON SPECIES OF *PHALERA* MOTHS FROM THE KUMAON HIMALAYA (INSECTA : LEPIDOPTERA : NOTODONTIDAE)

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The Indian administrative division of Kumaon occupies a section of the Himalayan range, west of the kingdom of Nepal and east of the administrative division of Garhwal. The present study was undertaken at Jones Estate, a site in the outermost range of hills at an elevation of 1500m above mean sea level, 2 km northwest of the town of Bhimtal in Nainital district, while one moth was obtained at Durgapur, 3 km by bridle path south of the town of Nainital.

Vegetation in Jones Estate consists of evergreen forest with Himalayan Oak (*Quercus leucotrichophora*) and Chir Pine (*Pinus roxburghii*) as nodal species; the upper limit of the miscellaneous deciduous type with *Bauhinia variegata, B. vahlii, Sapium insigne, Erythrina* and *Ficus* as representatives and finally, a large selection of exotics including trees, shrubs and annuals.

The climate tends towards the tropical, with a maximum summer temperature of ± 36°C in June and a minimum of 0°C in January, although in some years, the temperature does not descend below 4°C. Rainfall is heavy, especially during the south-west monsoon from June to September.

Table 1. Species of *Phalera* moths in Kumaon

Species	Vertex of head	Vertex of thorax	FW apical buff patch
procera	white	dark brown	brown, hardly contrasting with rest of wing. Proximally rounded.
grotei	white	buff	buff, proximally rounded with the postmedial lunulate band continued through it as a pale, undefined band.
parivala	buff	buff	buff, proximally defined by the dark, lunulate postmedial line, so that this patch is elongate, with the inner edge lunulate.
raya	buff	buff	buff, proximally rounded.

Genus *Phalera* Huebner

This genus ranges from Europe and Japan southwards through Asia to Borneo and Africa, reaching as far south as Australia. In India, at least ten species are known from the eastern Himalaya, the north-eastern hill states and south India. Only one species was reported from the Himalaya west of Nepal. This is a member of the *P. raya* group, probably *P. raya* (Hampson 1892). He records the moth from Shimla in Himachal Pradesh, which is at an elevation of 2130 m. This appears to be the highest elevation to which they ascend. These moths are more frequently met at lower elevation and are quite common at the study site.

They are univoltine, the adults emerging during the rainy season. Some unusually late records suggest a delayed emergence of overwintered individuals rather than a rapidly developed second brood. The flight is not very powerful, despite the hawkmoth-like build of these moths. They settle readily and can spend the whole night and the following day in one position, resuming activity at dusk. After settling on a surface, they rest initially much as normal moths do, with the forewings covering the hindwings and held tent-like over the abdomen. At this stage, they either fly off again soon to a more attractive perch or else, if satisfied, roll their forewings around their abdomen so that they assume a cylindrical shape. In this position, they are known to resemble, to a remarkable extent, a dry twig, the apical buff patch on the forewing representing the broken off tip of the twig.

If disturbed in this position, they prefer to go through the act of being a dry twig, up to the point of dropping off their perch and landing with a chitin-jarring thud, if necessary. If, however, they continue to be disturbed in a manner that makes clear to them that their disguise has been seen through, they do not have any further stratagem than to unroll their wings and, after vibrating them to achieve flight-temperature, fly off to a safer perch. This, naturally, does not happen often in nature. Even on such an incongruous surface as a white-washed wall, the rolled up *Phalera* are regularly overlooked by Himalayan Whistling Thrushes *Myiophonus caerueus*, White-cheeked Bulbuls *Pycnonotus leucogenys*, Grey Tits *Parus* sp., Whitecrested Laughing Thrushes *Garrulax leucolophus* among other birds that come to breakfast off insects attracted to light left on all night.

All the material examined was attracted to electric light, either 125 watt mercury vapour bulbs or ordinary

60 W or 100 W clear glass, tungsten filament bulbs. The majority appeared between dusk and 11 p.m., although stragglers are attracted sporadically throughout the night. During periods of heavy rainfall they are quite common and it is not unusual to find over ten individuals of one or more species clustered about a bulb. Both sexes are attracted to light, the males commoner than females. Freshly emerged as well as gravid females are attracted.

A tabular key to distinguish the four species is given in Table 1.

***Phalera parivala* Moore**

Horsfield, T. & F. Moore, 1857-59. Catalogue of the Lep. Insects in the Museum of the Hon. East India Co., Vol.2: 434.

Material Examined : 4 ex. : 5.vii. 1983; 9. viii. 1983; 7. viii. 1997; 14. viii. 1997.

Forewing Length : 31 - 35 mm.

Known Distribution : Sikkim, Nilgiris (Hampson op. cit.).

Remarks : A new record for Kumaon. Hampson gives the expanse as 80–90 mm but the specimens examined are smaller, from 70mm (FW 31mm) to 80 mm (FW 35mm). This is probably in keeping with the trend in several Lepidopteran genera that are larger in the eastern Himalaya than in the western Himalaya.

Unlike Hampson's description, the specimens examined have a subbasal rufous and grey band, proximally outlined by dark lines on the FW *recto*, which sharply defines the basal greyish suffusion. The cilia of the FW are not uniform bright chestnut but chequered with white, prominently so on the lower half of the forewing and less prominently on the upper half. The tip of the abdomen is ochreous, but Hampson does not mention this.

This is not a common species at the study site but, judging by its regular appearance, seems to be well established. Sevastopulo (1940) bred the species on *Lespedezia thompsoni* (Leguminosae). Although *L. thompsoni* does not occur in the study area, other members of the genus do. Though stragglers appear as late as September in some years, the main flight period is from early July to mid-August.

***Phalera procera* C. & R. Felder**

C. & R. Felder, 1875. Reise der Oesterr. Freg. Novara um die Erde. Lep. : Het., pl. 96, fig.1.

Material Examined : 5 ex. : 16.vi. 1994; 23. vi. 1981; 26. vi. 1981; 3.vii. 1983; 15. vii. 1996.

Forewing Length : 39 - 50mm.

Known Distribution : Sikkim, Nagas (India); Sylhet (Bangladesh) (Hampson *op. cit.*).

Remarks : A new record for Kumaon. The insect is common and well established in the study area.

Hampson gives an expanse of 81mm for males and 84mm for females of *procera* as well as *P. bobi* Swinhoe, which he treated as a synonym. The smallest specimen examined with a forewing length of 39mm has an expanse of 90mm and the female specimen with a forewing length of 50mm has an expanse of 110mm. The specimens examined are normal, in the sense that they are not unusually large individuals. It therefore appears that the western Himalayan population of *procera* is larger than the eastern Indian population.

Since Hampson noted *Phalera bobi* from "Bombay" (i.e. the erstwhile Bombay Presidency) and Burma, both of these localities have been left out of the above mentioned "known distribution" of *procera*. Holloway (1983) notes that *bobi* is also found in the Himalaya. *P. procera* is univoltine, with the main brood emerging from mid-June to mid-July. Stragglers appear through August and, in some years, even in September.

***Phalera raya* Moore**

Horsfield, T. & F. Moore, 1857-59. Catalogue of the Lep. Insects in the Museum of the Hon. East India Co. Vol.2: 433.

Material Examined : 13 ex. : 14. vi. 1981; 30.vi. 1981; 1.vii. 1983; 3. vii. 1983; 4. vii. 1983 x2; 5. vii. 1983; 7. vii. 1983 x2; 8.vii. 1983; 17.vii. 1995; 25. viii. 1997; 15.vi.1998.

Forewing Length : 30 - 43mm.

Known Distribution : Uncertain within Indian limits, since the distribution given by Hampson (1892) was for several species which he synonymised with *raya*. These have since been raised to species rank. Holloway (1983) says *raya* is Himalayan.

Remarks : This is probably the single *Phalera* species recorded from Shimla (Himachal Pradesh) noted by Hampson. It is the commonest member of the genus in the study area, with a flight period from mid-June until mid-July. The record from the last week of August is probably that of a straggler from the main brood rather than from a smaller second brood. It is therefore univoltine, like other members of the genus.

Hampson (*op. cit.*) gives an expanse of 76mm for males and 82mm for females, which includes *P. grotei* Moore, *P. cossoides* Walker and *P. amboinae* Felder. In the specimens examined, males with a forewing of 36mm have

an expanse of 84mm and females with an expanse of 43mm have an expanse of 97mm. Males with a forewing expanse of 30mm have an expanse of 70mm. These figures indicate that *raya* is rather more variable in size than was previously reported.

***Phalera grotei* Moore**

Horsfield, T. & F. Moore, 1857-59. Catalogue of the Lep. Insects in the Museum of the Hon. East India Co., Vol.2: 434.

Material Examined : 2 ex. : 20.viii. 1996; 6.vii. 1998 Durgapur, Nainital 1700m.

Forewing length : 35 - 38mm.

Known Distribution : Uncertain within India, but extending to Sumatra and Borneo (Holloway 1982).

Remarks : A rare species in the study area. Holloway (1983) notes that it is found at low elevation in Borneo, so perhaps it is commoner at low elevation in Kumaon. According to Holloway (1982), Kiriakoff (1968) gave erroneous distribution for most of the species in this group. The present record probably constitutes the western most limit of its range in the Himalaya as well as an altitudinal record for the species.

Compared with the male illustrated by Holloway (1983), the specimens examined are paler, with the orbicular and reniform as well as the antemedial, postmedial and submarginal markings clearly defined. These markings are obscure in the illustration. Such variation is to be expected from individuals from the drier western Himalaya.

P. grotei can be distinguished from the very similar *raya* in the Himalaya by the vertex of the head being white (brown in *raya*), the forewing *recto* being dark leaden grey (pale silvery grey in *raya*) with a basal suffusion of white scales below the costa which contrasts with the leaden grey on the remainder of the wing. The buff apical patch is proximally rounded as in *raya* and the postmedial lunulate band is continued through the buff sub-apical patch as a paler brown, lunulate band to the costa. This is not prominent or altogether obsolete in *raya*.

Discussion

The four species of *Phalera* discussed above have all been recorded from a single location. Given the varied topography and vegetation types that are met within Kumaon, it is not unlikely that one or more species of this genus will be added to the known fauna when a thorough survey is undertaken. None of the new records appear to be recent introductions to the area and the reason that these were not previously recorded is probably the lack of collections from below 1600m in the area.

As is to be expected in insects from the drier western Himalaya, the individuals are paler than eastern and southern Indian populations, so that the markings are clearer. This tendency is also evident in such diverse groups as the Neptini (Nymphalidae) , *Delias* Huebner (Pieridae) and *Aglais* Dalman (Nymphalidae) among others.

In the matter of size, there is some inconsistency, with *parivala* smaller and *procera* and *raya* larger than eastern and southern Indian populations. All the species appear to be univoltine and on the wing during the wettest part of the year. These moths are commoner in years of heavy rainfall and rather scarce in drought years.

During daylight hours, they depend entirely on their very effective camouflage for survival. They do not have the ability to "make a quick getaway" as do most Noctuids and even some Notodontids, but have to unroll their wings and vibrate them in order to achieve flight temperature.

References

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EFFECT OF AMBIENT AIR AT SEWRI, BOMBAY, ON POLLEN VIABILITY OF SOME ANGIOSPERMIC PLANTS

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Pollution is now the most important limiting factor for man. In the underdeveloped nations shortage of available food and resources is associated with chronic pollution and disease caused by human and animal wastes, while in the affluent or developed nations agroindustrial chemical pollution is now more serious than organic pollution. In addition, global