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# Taxonomic notes and new records of the genus *Sphingonaepiopsis* Wallengren, 1858 (Lepidoptera: Sphingidae) in Iran

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## Abstract

The taxonomy, morphology, biology and distribution of *Sphingonaepiopsis gorgoniades* (Hübner [1819]) and *S. nana* (Walker 1856) are reviewed. The validity of subspecies within *S. gorgoniades* is re-examined and it is concluded that there is no justification for their continued recognition. *Sphingonaepiopsis gorgoniades pfeifferi* Zerny 1933 is therefore confirmed as a synonym of *S. gorgoniades*. Records of *Sphingonaepiopsis* in the collection of the Hayk Mirzayans Insect Museum (HMIM), Tehran, Iran, are collated and mapped, and the first confirmed occurrence reported of the Afrotropical *S. nana* in mainland southwest Asia, an increase in the known range of the species. Global distribution maps are provided for both species.

**Key words:** Taxonomy, *Sphingonaepiopsis*, Iran

## Introduction

During a survey of the lepidopteran family Sphingidae (hawkmoths) in the Hayk Mirzayans Insect Museum (HMIM), the largest insect museum of Iran, the second author (RZ) discovered specimens of the genus *Sphingonaepiopsis* collected from different parts of Iran. Most proved to be *Sphingonaepiopsis gorgoniades* (Hübner [1819]), hitherto the only species recorded from Iran. However, two specimens from the south of the country differed in wing colour and pattern, and dissection of the male genitalia demonstrated they belonged to the Afrotropical species, *Sphingonaepiopsis nana* (Walker 1856). These specimens are the first confirmed records of this species from mainland southwest Asia and represent an extension to the known range of the species.

In this paper, we review the taxonomy, morphology, biology and distribution of *S. gorgoniades* and *S. nana,* including diagnostic features for identification, summaries of data on larval host plants and distribution maps. We also re-examine the validity of subspecies within *S. gorgoniades* and conclude there is no justification for their continued recognition.

## *Sphingonaepiopsis* Wallengren, 1858

*Sphingonaepiopsis* Wallengren, 1858, *Oefvers. K. VetenskAkad. Foerh. Stockh.* 15: 138.
Type species: *Sphingonaepiopsis gracilipes* Wallengren, 1858, by original designation.

The genus *Sphingonaepiopsis* comprises some of the smallest of all hawkmoths, with wingspans of 25–35 mm. There are currently seven recognized species (Kitching & Cadiou 2000), distributed throughout the Old

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World. *S. gorgoniades* and *S. kuldjaensis* (Graeser 1892) have Palaearctic distributions; the former has been recorded from SE Europe, east to the southern Urals, Afghanistan and NE Tajikistan (possibly reaching as far as Eastern Siberia, see below), and the latter is restricted to the mountains of Central Asia, from NE Afghanistan, through the Tian Shan, to eastern Kazakhstan and NW China. *S. ansorgei* Rothschild 1904 and *S. nana* are Afrotropical; the former is restricted to East Africa (from Kenya and Uganda to South Africa), and the latter occurs throughout sub-Saharan Africa, also in the Arabian Peninsula, and is here confirmed for the first time from Iran (see below). *S. malgassica* Clark 1929 and *S. obscurus* (Mabille 1880) are endemic to Madagascar, the former restricted to the south of the island, the latter found throughout (Griveaud 1959). Finally, *S. pumilio* (Boisduval [1875]) is SE Asian, occurring from NE India, through Burma and Thailand, to Peninsular Malaysia and Singapore, with populations also in eastern and south-eastern China.

## Taxonomy

*Pterodonta* Austaut, 1905, *Ent. Z.* 19: 29.

Type species: *Proserpinus gorgoniades* Hübner ([1819]) *Verz. bekannter Schmett.*: 132, by original designation (but cited as *gorgoniades* Herrich-Schäffer, an incorrect authorship). A junior homonym of *Pterodonta* R. L., 1817, *Jena. allg. Lit.-Ztg*, 1: 286 (Lepidoptera: Noctuidae). The objective replacement name is *Neopterodonta* Eitschberger (1999).

*Neopterodonta* Eitschberger, 1999, *Atalanta* 30: 292.

Type species: *Proserpinus gorgoniades* Hübner, ([1819]), by original designation. *Neopterodonta* was established as the objective replacement name for *Pterodonta* Austaut. **Syn. nov.**

On the basis of male and female genital structure, Danner *et al.* (1998) resurrected *Pterodonta* Austaut 1905 for *S. ansorgei*, *S. gorgoniades* and *S. kuldjaensis*, retaining *S. nana*, *S. malgassica*, *S. obscurus* and *S. pumilio* in *Sphingonaepiopsis*. However, they made direct observations on the male genitalia of only *S. nana*, *S. gorgoniades* and *S. kuldjaensis*, basing their conclusions regarding *S. ansorgei* on the small monochrome photograph of Carcasson (1968), those regarding *S. obscurus* and *S. pumilio* on the line drawings of Rothschild & Jordan (1903) and making no reference at all to the genitalia of *S. malgassica*.

Kitching & Cadiou (2000) studied the male genitalia of all seven species and found much more variation among them than was described by Danner et al. (1998). In particular, *S. ansorgei* did not appear to be closely related to *S. gorgoniades* and *S. kuldjaensis*, and the genitalia of *S. obscurus* and *S. malgassica* were as different from each other as they were from the other species of the genus. Danner *et al.* (1998) also commented that the final instar larvae of *S. gorgoniades* and *S. ansorgei*, as illustrated by Pinhey (1962), were markedly different in shape and pattern, which was unexpected given their alleged close relationship. However, Kitching & Cadiou (2000) noted that Pinhey's (1962) illustration was actually of *S. nana*, and that the true larva of *S. ansorgei* was that described by Carcasson (1968) (and Pittaway 1993) as *S. nana* (Sevastopulo 1971). The habitus of the final instar larva of *S. kuldjanesis* (Zolotuhin 1994) is intermediate between those of *S. gorgoniades* and *S. nana*, and the larva of *S. pumilio* (Mell 1922; Bell & Scott 1937) appears identical to that of *S. nana* (Sevastopulo MS notes in BMNH). Given this conflicting evidence from adults and larvae, and that other genera should be analysed to determine their relevance to the problem, Kitching & Cadiou (2000) considered division of *Sphingonaepiopsis* was premature and resynonymized *Pterodonta* with *Sphingonaepiopsis*. The establishment of *Neopterodonta* as the new replacement name for the homonymous *Pterodonta* by Eitschberger (1999) resolved a minor nomenclatural issue. It, too, was synonymized with *Sphingonaepiopsis*, by de Freina & Piatkowski (2006).

## *Sphingonaepiopsis gorgoniades* (Hübner, [1819])

### Taxonomy

*Proserpinus gorgoniades* Hübner, [1819], *Verz. bekannter Schmett.*: 132.

Type(s) [Russia:] lower Wolga [lower Volga river [unknown depository, probably lost].

Hacker (1999: 452) found no authentic type material in ZSBS, Munich or LM, Wiesbaden. *Proserpinus gorgoniades* was proposed as the new replacement name for *Sphinx gorgon* Esper. Transferred to *Sphingonaepiopsis* by Rothschild & Jordan (1903: 591); to *Pterodonta* by Danner *et al.* (1998: 179, 180); to *Sphingonaepiopsis* by de Freina & Piatkowski (1999: 267); to *Neopterodonta* by Eitschberger (1999: 292); then back to *Sphingonaepiopsis* by Kitching & Cadiou (2000: 66).

*Sphinx gorgon* Esper, [1803–1804], *Die Schmett.* 2 (suppl. 2): 49.

Type(s) [Russia:] lower Wolga [lower Volga river [unknown depository, probably lost].

Hacker (1999: 452) found no authentic type material in ZSBS, Munich or LM, Wiesbaden. A junior primary homonym of *Sphinx gorgon* Cramer (1777, *Uitlandsche Kapellen…*: 73, pl. 142, fig. E) (now *Enyo gorgon*). The new replacement name is *Proserpinus gorgoniades* Hübner ([1819]).

*Sphingonaepiopsis gorgon pfeifferi* Zerny, 1933, *Dt. ent. Z., Iris* 47: 60. **SYN. REV.**

Lectotype ♂ Lebanon: cedar forests above Becharré, 1900m, 12–19.vi.1931 (E. Pfeiffer & H. Zerny) [NHMV]; implicitly designated by Danner *et al.* (1998: 46).

The type material of *Sphingonaepiopsis gorgon pfeifferi* was originally listed by Zerny (1933) as "♂♀ — Taf. 1 Abb. 28. — [Description] — B., Zed., Mitte 6 mehrere ♂, 1♀ am Licht (Pf., Z.). Typen im Mus. Wien, Paratypen in coll. Daniel." "B." and "Zed." refer to the collecting localities "Becharré, 1400m" and "Umgebung des Zedenwäldschens oberhalb Becharré, 1900m" respectively, and "Pf." and "Z." to the collectors, E. Pfeiffer and H. Zerny. Thus, although it is likely that Zerny intended a holotype male and an "allotype" female, deposited in NHMV, he did not explicitly designate the male as the holotype. Thus, there were two syntypes, a male and a female. Danner *et al.* (1998, legend to plate 21, figure 13) then implicitly designated the former as the lectotype by stating, "[Holo]type ♂ von *Sphingonaepiopsis gorgon Pfeifferi* ZERNY, Nd. Libanon, Cedern b. Becharré, 1900m, 12.—19.vi.[19]13, ZERNY, Naturhistorisches Museum, Wien". The fact that the specimen was labelled as "type" has no bearing on the issue.

*Sphingonaepiopsis pfeifferi chloroptera* von Mentzer, 1974, *Acta ent. Jugosl.* 10: 150.

Holotype ♂ Yugoslavia, Macedonia: near Skopje, Matka, 24.vii.1971 (E. von Mentzer) [NHRS]. Erik von Mentzer's collection is in the Naturhistoriska Riksmuseet, Stockholm, Sweden (M. R. Honey, pers. comm.).

*Sphingonaepiopsis gorgoniades* was described from specimens collected along the lower Volga River, most likely around or between the present day cities of Saratov and Volgograd in southern Russia. Specimens from this area are characterized by relatively dark, usually grey, forewings and reduced cream markings on the hindwings. Later, Zerny (1933) described specimens from north Lebanon as a separate subspecies, *Sphingonaepiopsis gorgoniades pfeifferi*, characterized essentially by paler brown forewings and extensive cream markings on the hindwings, but also by the longer and thicker antennae and somewhat broader forewings. On the basis of these features, together with small differences in the male genitalia, von Mentzer (1974) raised *pfeifferi* to species status. He also described a second subspecies thereof, *Sphingonaepiopsis pfeifferi chloroptera*, based on a single specimen from Matka, near Skopje (now in the Former Yugoslavian Republic of Macedonia), where it was purported to be sympatric with *Sphingonaepiopsis gorgoniades*.

Pittaway (1983) treated both *pfeifferi* and *chloroptera* as subspecies of *S. gorgoniades*. With regard to the former, he stated that it was distinguished from the nominotypical subspecies by "its lighter, brownish forewings and very extensive buff or orange speckling on the hind- and forewings" but that it "forms a north/south cline with *S. g. gorgoniades*, with intermediate forms." Regarding the latter, he characterized it as having the "forewing darker, with a violet tint" and the "hindwings heavily suffused with orange speckling".

However, “some individuals of subsp. *gorgoniades* from the Crimea closely resemble subsp. *chloroptera* and there are intermediate forms.”

De Freina & Witt (1987) recognized no subspecies within *S. gorgoniades*, listing both *pfeifferi* and *chloroptera* as junior synonyms, but gave no explicit argumentation for so doing. Subsequently, Pittaway (1993) reinstated both *pfeifferi* and *chloroptera* as subspecies of *S. gorgoniades*. He commented that the species-level separation of *pfeifferi* by von Mentzer (1974) on minor morphological grounds could not be justified, noting that in Turkey, the ranges of the two taxa are contiguous giving rise to intermediate forms. Pittaway (1993) further observed that individuals from more humid areas within the range of *S. g. pfeifferi* were darker and tended towards *S. g. gorgoniades*. With regard to *S. g. chloroptera*, Pittaway (1993) likewise noted that some specimens of *S. g. gorgoniades* from the Crimea were almost indistinguishable from *S. g. chloroptera* from the Balkans.

Following a detailed study of the related species, *Sphingonaepiopsis kuldjaensis*, Zolotuhin (1994) concluded that “such characters as male and female genitalia, wing pattern and colouration cannot be used with reliable authenticity for the establishment of new taxa within the *gorgoniades*-group. Moreover, the character that had been laid in the foundation of description of the taxon *chloroptera* Metz., namely yellow hindwings, is not a taxonomic one because the yellow colouration of the hindwings and contrast in the forewing pattern are typical for the second generation of the *gorgoniades*-group on the whole”. As a result, he considered it reasonable to treat *S. g. chloroptera* as a junior synonym of *S. g. gorgoniades*, but did not formalize the act. This was later done by Danner *et al.* (1998), who nevertheless retained subspecific status for *S. g. pfeifferi*.

Pittaway (1997–2007) returned to the taxonomy of de Freina & Witt (1987) and treated both *pfeifferi* and *chloroptera* as forms of *S. gorgoniades*. He considered that the observed variation within this species was due to an interaction of two separate processes. First, the various populations had been restricted to a number of isolated refugia during the last Ice Age, where they had developed small differences, but having subsequently come back into contact were now in the process of reintegrating. Second, the differences in colour pattern and contrast are at least partly environmentally induced, so that in more humid areas moths tend to be larger, darker and more contrastingly patterned (form *chloroptera*) and in drier areas, moths are smaller, paler and less contrastingly marked (form *pfeifferi*). As is other sphingids, such as *Hyles hippophaes* (Esper 1789), *Smerinthus kindermannii* Lederer 1853 and *Theretra alecto* (Linnaeus 1758), this pattern differentiation is probably determined by the conditions experienced by the pupae (Pittaway 1997–2007), such that pupae exposed to cooler, damper conditions produce darker, well-marked adults and pupae exposed to warmer, drier conditions produce paler, less well-marked adults. This would explain the observation of Zolotuhin (1994) that spring generation moths, produced from overwintering pupae, are darker and summer generation moths are paler. This arrangement, with no subspecies recognized, was endorsed by Schulze & Weigert (2006) and is formalized here.

## Morphology

*Sphingonaepiopsis gorgoniades* (Figs. 1 & 2) is a small sphingid with a wingspan of 25–35 mm. The scaling of the head and thorax is somewhat raised, giving the moth a rough and unkempt appearance. The forewing upperside is pale grey, with a dark brown basal band and an angled median band of the same colour, within which is a conspicuous, elongate, white discal spot. The outer margin of the forewing is slightly excavate between the apex and vein $M_3$, and veins $M_3$ and $CuA_1$ are strongly produced into a rounded lobe that is slightly notched between these veins. The hindwing upperside is greyish-brown with a variable amount of cream markings between the base and submarginal area (see above). The antennae of the male are shortly pectinate. The second, third and fourth abdominal segments each have a conspicuous pair of subdorsal white spots.

In the male genitalia (Fig. 3) the uncus is broad, almost straight and apically rounded; the gnathos is strongly sclerotized and directed horizontally; the harpe is a short, broadly rounded lobe that lacks spines; and the aedeagus bears a large, antero-dorsally directed apical spine. In the female genitalia, the postvaginal plate is broad, and both the antrum and signum are short.

**FIGURE 1.** *Sphingonaepiopsis gorgoniades*, adult male, Russia: S. Ural, Orenburg district [Orenburgskaya Oblast'], Donskoje village 6km W mount Verbljushka, 30.v.1998, T. & K. Nupponen leg., BMNH(E) 2002–103, BMNH (E) #274440.

**FIGURE 2.** *Sphingonaepiopsis gorgoniades*, adult male, Iran: Golestan, Almeh, 1650m, 7–14.v.1993, Pazuki & Badii leg. (HMIM).

## Distribution in Iran

Material examined in HMIM: 3♂, Golestan: Almeh, 1600 m., 26–29.x.1986 (Pazuki); 1♀, Golestan, Almeh, 1650 m., 17–25.v.1988 (Pazuki); 1♂, Golestan, Almeh, 1650 m., 7–14.v.1993 (Pazuki & Badii); 1♀, Golestan, Gorgan, S.W.Hills, 17.v.1975 (Maschayekhi). West Azerbaijan: 1♂, Bazargan; 2♂, Tehran: Karaj, Kandovan, Sarchal, 2800 m., 4–8.vii.1977 (Pazuki & Mortazaviha); 1♂, Lorestan: Oschtorankuh, Narmian, 2400 m., 4–5.viii.1975 (Pazuki).

## Global distribution (Fig. 4)

In Europe, there are scattered localities in the Balkans: W Croatia (Zerny 1933; Schultze & Weigert 2006), Macedonia (von Mentzer 1974), N, C and S Greece (de Freina & Piatkowski 1999, 2006; Schultze & Weigert 2006), NE Bulgaria (Beschkow 1990; Danner *et al.* 1998) and SE Romania (Mihuț & Dincă 2006). It then extends east to the north and south of the Kazakh steppe. In the north, there are records from the Crimean peninsula, Ukraine (Zerny 1933; Ėfetov & Budashkin 1990) and across south Russia (Eversmann 1844; Danner *et al.* 1998) as far as the southern Urals (Nupponen & Fibiger 2002). In the south, it extends east through Turkey (Daniel 1932; de Freina 1981, 1983; Danner *et al.* 1998; de Freina & Piatkowski 1999), Lebanon (Zerny 1933; Ellison & Wiltshire 1939; Danner *et al.* 1998), Israel (Müller *et al.* 2005a), Jordan (Müller *et al.* 2005b), Armenia (Danner *et al*. 1998), Azerbaijan (specimens in BMNH), NE Iraq (Haj Omran, on the border with Iran; Wiltshire 1957), Iran (this paper), S Turkmenistan (Danner *et al.* 1998) and SE Kyrgyzstan (specimens in BMNH from the Kyzylart Pass on the border with Tajikistan). Pittaway (1997–2007) cited Eversmann (1844) as the source of records from Kazakhstan but this is an error. Pittaway appears to have misinterpreted Eversmann's locality, Sarepta, as the settlement in Kazakhstan at 49° 40'N, 72° 23'E (http://www.fallingrain.com/world/KZ/0/Sarepta.htm). Eversmann wrote that *S. gorgoniades* "volat raro ad Volgam inferiorem, circa Sareptam", indicating that the Sarepta in question is that in south Russia, near Volgograd, at 44°31'40", 44°29'01"E (http://www.fallingrain.com/world/RS/84/Sarepta.html), now called Krasnoarmeisk (Anikin *et al.* 2000). However, Danner et al. (1998) mapped several records from NE Kazakhstan (and also one in the extreme west, all unfortunately without detailed locality data that would permit precise mapping in the present paper). Pittaway (1997–2007) also commented that the species occurred "across southern Siberia to the Altai Mountains, and possibly Amurland (Russia) [and] may also occur in Mongolia and northern China". There are no published records to substantiate these statements, but they may be based, at least in part, on two females in BMNH that were part of the Crowley bequest (BMNH accession number 1901–1907) and are labelled "Amur". However, the BMNH Accessions Register for the period 1901– includes the following annotation to the Crowley bequest: "note specimens labelled "Amur" are from Turkestan (probably Neu Margelan)". Neu Margelan is currently known as Farg'ona, in Uzbekistan. Finally, Ebert (1969) and Daniel (1971) cited specimens of *S. gorgoniades* from E Afghanistan. We have examined a colour photograph of one of these specimens, a male from Khurd-Kabul in the collection of the Naturhistorisches Museum, Vienna, Austria, and confirmed its identity. Thus, we can extend the limit of the distribution of *S. gorgoniades* further east and southeast than is shown on the map of Danner *et al.* (1998) but not yet beyond 80°E.

## Biology

*S. gorgoniades* is an inhabitant of open scrub and hilly steppe, where it forms small and locally distributed colonies (Pittaway 1997–2007). In the Balkans and Turkey, *S. gorgoniades* lives in warm, sunny places with high humidity, preferring small depressions within forest-bordered meadows between 800 and 1600m (de Freina & Witt 1978). Didmanidze (1978) reported the species as being rather common in Georgia in savannah-type forests, river valleys and montane xerophytic habitats between 300 and 2500m, whereas in Jordan, *S. gorgoniades* prefers old oak forests (Müller *et al.* 2005b). In Iran, the Golestan forests near Almeh, situated in the northeast Elburs Mountains at 1600–1700m, are mostly semi-montane biotopes. Kandovan is situated in the higher elevations in the Elburs Mountains (2500–3000m). The northern and southern slopes have completely different vegetation, the former being much more humid and the latter having more semi-desert habitats. Bazargan near the border with Turkey has semi-montane to montane biotopes. Oschtorankuh is situated in the Zagros Mountains, in the centre of Iran, and consists of high elevation, semi-desert biotopes (Hangay *et al*. 2005).

The species is bivoltine. Throughout most of the species' range, adults mainly fly from late May and early June, followed by a second generation in late July to early August (Pittaway 1997–2007). In more northerly localities, such as the southern Urals, the first generation flies somewhat later with only a partial second generation (Nupponen & Fibiger 2002), while in the southern part of the range, individual moths may be found as early as April and as late as September (Pittaway 1997–2007). The present record from Almeh at the end of October is thus particularly late, but not as late as the specimen illustrated by Danner *et al.* (1998: plate 21, fig. 6) that was collected near Garrygala in the Kopet Dag of Turkmenistan on 15 November 1995.

The immature stages were described and illustrated by Danner *et al.* (1998, as *Pterodonta g. gorgoniades*). The mature larva has several colour forms in which the ground colour is pinkish-brown, bluish-green or yellowish-green. Superimposed onto this are a series of seven longitudinal white stripes in the dorsal, subdorsal, lateral and sublateral positions. The areas of ground colour between the stripes are speckled with numerous fine white dots.

The recorded food plants are species of *Galium*, particularly *G. verum* (Boisduval [1875]; Bartel 1899–1902; de Freina & Witt 1987; Pittaway 1993; Danner *et al.* 1998). Pittaway (1997–2007) lists other, unspecified species of Rubiaceae as minor host plants but we not found published records to confirm this statement. Feeding, on flowers in preference to leaves, takes place mostly at night and the larvae readily drop of the plant when disturbed (Pittaway 1997–2007).

**FIGURE 3.** *Sphingonaepiopsis gorgoniades*, male genitalia (aedeagus at right), Iran: Lorestan, Oschtorankuh, Narmian, 2400m, 4–5.viii.1975, Pazuki leg. (HMIM).

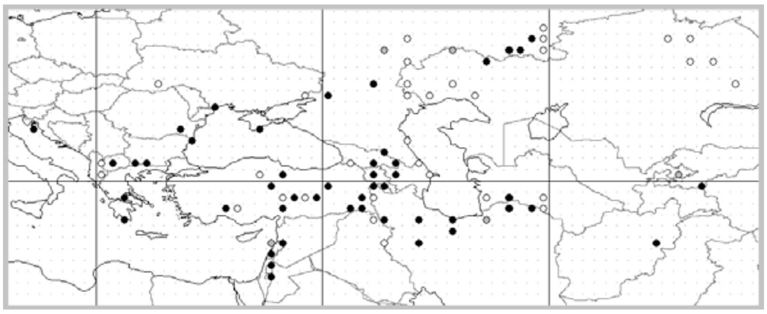

**FIGURE 4.** *Sphingonaepiopsis gorgoniades*, global distribution at a resolution of one degree of latitude and longitude. Black spots indicate records for which precise locality information has been determined, databased and georeferenced within the square concerned. Grey spots indicate records for which approximate and/or unconfirmed locality information has been determined, databased and georeferenced and allocated to the square concerned; the record may actually relate to a neighbouring grid cell but we have been unable to determine this from the data available. Open circles represent additional data points mapped by Danner et al. (1998) but for which no precise locality data was provided. Due to differences in grid systems, these mappings are only approximate and some may relate to adjacent grid cells or be duplicates of georeferenced records therein. Georeferenced records are based on all collections and literature sources known to the authors; details are available on request.

### *Sphingonaepiopsis nana* (Walker, 1856)

#### Taxonomy

*Lophura nanum* Boisduval, 1847, *in*: Delegorgue, *Voyage Afrique australe* 2: 594.

Rothschild & Jordan (1903: 592) erroneously treated this *nomina nuda* combination as the valid and available name for this taxon.

*Lophura nana* Walker, 1856, *List Specimens lepid. Insects Colln Br. Mus.* 8: 107.

Syntypes 2 [South Africa: Natal,] Port Natal [Durban] (ex coll. Gueinzius) [BMNH]. Transferred to *Sphingonaepiopsis* by Rothschild & Jordan (1903: 591 (key), 592).

*Sphingionaepiopsis gracilipes* Wallengren, 1858, *Öfvers. K. VetenskAkad. Förh. Stockh.* 15: 138.

Type(s) [South Africa:] Caffraria [(J.A. Wahlberg)] [NRHS]. This name was proposed again as a new species by Wallengren (1860, *Wiener Entomologische Monatschrift*, 4: 42). Synonymized with *Sphingonaepiopsis nanum* [sic] by Rothschild & Jordan (1903: 592).

#### Morphology

*Sphingonaepiopsis nana* (Figs. 5 & 6) is another small sphingid with a wingspan of 25–30 mm. It is distinguished from *S. gorgoniades* by its smoother general appearance, browner forewing upperside ground-colour, less variegated and contrasting forewing upperside pattern, less pectinate male antennae, more rounded and even forewing outer margin, more uniform orange-brown hindwing upperside, and inconspicuous or no paired dorsal white spots on the abdomen.

The structures of the male genitalia (Fig. 7) are characteristic: the uncus is relatively narrow, pointed, and strongly curved; the gnathos is formed from two broad, ventrally directed membranous lobes; the dorsal edge of the harpe bears a distinctive comb of strong, ventro-distally directed teeth and a short, blunt lobe projecting from its ventral margin; and the aedeagus is apically unarmed. In the female genitalia, the postvaginal plate is narrow, and both the antrum and signum are both long.

#### Distribution in Iran

Material examined in HMIM: 1♀, Hormozgan: Issin, 130 m., 28–30.iv.1977 (Pazuki & Haschemi); 1♂, Kerman: Jiroft, Dehbakri, 1850 m., 3–4.x.1993 (Haschemi & Ebrahimi). These two specimens are presently the only known confirmed records of this species in Iran and represent an extension to the previously know distribution of the species. Pittaway (1993) reported this species from Iranian Baluchistan but details of this record could not be confirmed.

#### Global distribution (Fig. 8)

*S. nana* is found throughout sub-Saharan Africa, from Sierra Leone east to Kenya and south to South Africa. It appears to be absent from the central African forest belt, but this may be due to undersampling rather than to real absence. Carcasson (1968) noted that *S. nana* is a crepuscular species frequently seen feeding from flowers. In Thailand, *S. pumilio* was likewise only captured while feeding from flowers at dusk and was never attracted to light (I. J. Kitching, unpubl. obs.). If *S. nana* behaves likewise, this may account for the relative scarcity and patchiness of records. Outside continental Africa, *S. nana* has long been known to occur at the southern tip of the Arabian Peninsula near the port of ’Adan (Aden) in southern Yemen (Butler 1884; Rothschild & Jordan 1903). More recently, Wiltshire (1990) reported the species further north along the west coast of the Arabian Peninsula, at Qanuna, in the Asir Mountains of south-western Saudi Arabia, and Jiddah, as well as from the *Prosopis/Acacia* dominated coastal plain west of Muscat, Oman (E. P. Wiltshire, pers. comm. to A. R. Pittaway, cited by Pittaway 1993). The new records reported here represent a considerable extension to the known range of the species. *S. nana* is essentially an Afrotropical species that in the Arabian Peninsula is generally restricted to coastal (and thus warmer) localities (A. R. Pittaway, pers. comm.). However, Pittaway (1997–2007) speculated that the high altitude of the Jiroft record (1850m) may indicate *S. nana* is able to tolerate quite cold and dry conditions and suggested that the species may be found elsewhere in southern Iran and even further east into SW Pakistan.

**FIGURE 5.** *Sphingonaepiopsis nana*, adult male, [Yemen:] Aden [ʻAdan], B.M. 1884-43, BMNH(E) #274439.

**FIGURE 6.** *Sphingonaepiopsis nana*, adult male, Iran: Hormozgan, Issin, 130m, 28–30.iv.1977, Pazuki & Haschemi leg. (HMIM).

**FIGURE 7.** *Sphingonaepiopsis nana*, male genitalia (aedeagus at right), Iran: Kerman, Jiroft, Dehbakri, 1850m, 3–4.x.1993, Haschemi & Ebrahimi leg. (HMIM).

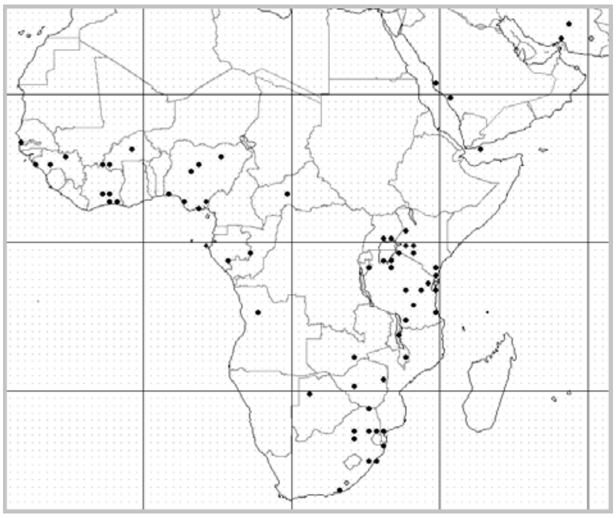

**FIGURE 8.** *Sphingonaepiopsis nana*, global distribution at a resolution of one degree of latitude and longitude. Black spots indicate records for which precise locality information has been determined, databased and georeferenced within the square concerned. Grey spots indicate records for which approximate and/or unconfirmed locality information has been determined, databased and georeferenced and allocated to the square concerned; the record may actually relate to a neighbouring grid cell but we have been unable to determine this from the data available. Georeferenced records are based on all collections and literature sources known to the authors; details are available on request.

## Biology

In Sub-Saharan Africa, the moth has been recorded as flying during almost every month of the year. The capture dates of the two Iranian specimens are difficult to interpret but may be indicative of two generations.

Kitching & Cadiou (2000) clarified the confusion surrounding the immature stages of *S. nana*. The description of the larva given by Carcasson (1968) (and repeated by Pittaway 1993, 1997–2007) is actually that of the related species, *S. ansorgei*, an error that had been rectified by Sevastopulo (1971). The true larva of *S. nana* was that misidentified by Pinhey (1962, plate 14, figure 19) as *S. ansorgei*. The final instar larva of *S. nana* has a thin, straight anal horn (laterally compressed and somewhat spatulate in *S. ansorgei*) and a strong, white lateral stripe edged in orange-brown that contrasts with the green ground colour (blackish-brown in *S. ansorgei*). The known larval host plants of *S. nana* in Africa are *Galium* (MacNulty 1970), *Hedyotis* (= *Oldenlandia*) (Sevastopulo 1971; Vuattoux *et al*. 1989)*, Kohautia, Jaubertia* and *Rubia* (all Pittaway 1993), all of which belong to the family Rubiaceae, and it is likely that this is the family fed upon in Iran.

Of the two localities of *S. nana* in Iran, Dehbakri is a situated at high elevation (over 2000 m) in the south eastern part of the Zagros Mountains north of Jiroft, in a biotope dominated by *Pistacia khinjuk* plantations and *Astragalus*. The second locality, Isin, is situated in the south of Iran, where the climate semi-tropical and the habitat consists of biotopes dominated by *Prosopis* and *Acacia*.

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