LIFE HISTORY ALTERNATIVES IN THE GENUS CHEUMATOPSYCHE (TRICHOPTERA: HYDROPSYCHIDAE) IN SOUTHERN AFRICA.

by

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The family Hydropsychidae is one of the two most important families of caddisflies in the Afrotropical Region, with two subfamilies. Of these, the Hydropsychinae includes two genera, Hydropsyche and Cheumatopsyche, the former being poorly represented in southern Africa. There are 55 known species of Cheumatopsyche in the Afrotropical Region, with more still being described (Scott, 1983). Most of these are Central African, but 12 have been recorded from southern Africa. This paper deals with three of the southern African species of Cheumatopsyche.

Cheumatopsyche larvae are largely restricted to running water habitats, various species showing very different tolerances to unfavourable physicochemical and biological conditions, and consequent abilities to adapt to wider or more restricted ranges of distribution. C. maculata is stenotopic, while C. afra and C. thomasseti are much more eurytopic. Their distribution, habitat types and tolerances to water quality and to siltation are indicated below.

Hydropsychid larvae have branched abdominal gills which assist them in extracting oxygen from the running water. They are very active, older larvae building shelters and spinning nets to filter food from the flowing water, whether smaller invertebrates (including Simulium larvae), algae or detritus. Cheumatopsyche larvae have stridulators which they use to signal to other larvae, and thus demarcate their territories, particularly where overcrowding occurs, defending them if necessary.

Cheumatopsyche maculata (Mosely) 1934

This species is very clearly recognizable both as male imagos and as larvae. Nowhere very common, it appears to be restricted to small highlying streams, fast-flowing, clear, cold, acid, oligotrophic and unpolluted, in the coastal ranges of the Cape Province. The larvae make small shelters and spin nets either in mid-stream, often under stones, or in crevices in cascades. They appear to be able to survive the worst droughts in the tiny trickles that persist, deriving from Table Mountain Series rocks (West Cape) or Witteberg quartzites (East Cape) - also a Table Mountain System formation.

Two variants of larvae exist. Those from the small hill streams round Grahamstown, bred out to undoubted maculata imagos, are usually plain brown in colour, whereas those from the small upper tributaries of the Eerste, Berg, Breede and Riviersonderend Rivers in the West Cape have a wine glass-shaped light patch on the brownish frontoclypeal apotome. Nevertheless, from the distribution of the imagos, we believe these to be the same species as in the East Cape. The type locality of C. maculata is Stellenbosch (ie the Eerste River).

Spring and early summer larvae are small, later mixed in size; pupae have been collected in October, imagos in December and March; they may thus be univoltine, with an extended emergence period, or bivoltine. Insufficient data are available to elucidate which.

Somewhat similar larvae occur in the Natal Drakensberg, but no imagos are available to validate the species.

Cheumatopsyche afra (Mosely) 1935

Also an upper river species on the whole, tending to occur in fast-flowing water, whether stony runs or cascades, from the mountain torrent zone to the foothills. It is able to withstand quite high salinity values, droughts and floods, but not organic pollution or high silt loads, normally being found in clear, clean streams.

This taxon has a very wide distribution in the Afrotropical Subregion. Originally described from Sierra Leone, it has also been recorded from Abyssinia, Tanganyika, Zambia, Zimbabwe, Zaire, Angola and South Africa (all provinces). It has been suggested (Kimmins, 1960) that although at first afra seemed to be a complex of closely related species, he believed it was in fact merely a very variable and widespread species. Even within South Africa, afra shows much variation, from very dark individuals (both adults and larvae) in cold montane areas, to much paler ones in warmer foothill streams. The larvae look different in various respects, but both types have been bred out to undoubted afra imagos.

In the West Cape, mainly Great Berg River records, imagos were caught from August to December and also in March, so that it may be bivoltine or have an extended emergence period.

It is of much interest to note that before the Orange River water came through to the East Cape, C. afra was the only species found in the Sundays River, and C. thomasseti the only one in the Great Fish River. Since the inflow, which has made the Great Fish a permanently flowing river with a lower silt load, afra has appeared in it, and at times is the commoner of the two. No doubt it derives from the small permanent tributaries in the upper Fish River catchment, but could not establish itself in the Great Fish while it was subject to severe droughts which left only stagnant pools in places, followed by heavily mud-laden floods. Although very high salinities were found in the Great Fish earlier on, similarly high values were found in the Sundays, though with a higher sodium salt balance. The Sundays, too, was subject to alternate droughts and floods, but not to the heavy silt loads seen in the Great Fish (due to silt trapping in Lake Mentz).

C. afra appears to be a widely distributed, variable, eurytopic species, with an environmental tolerance varying from cool mountain streams with low salinities to the warm temperatures and high salinities in lower reaches of rivers.

Cheumatopsyche thomasseti (Ulmer) 1931

Originally described from Natal, thomasseti is widespread in southern Africa, having been recorded from Angola, Zimbabwe and South West Africa, as well as South Africa (all provinces). We have also had undoubted larvae from Kenya and Ethiopia, but to date no adults.

It is a more tolerant species than either afra or maculata, tending to occur lower down in streams and rivers where temperatures may be higher and silt loads heavier. It may, however, also be found together with afra higher upstream. The main difference between it and afra in habitat occupation appears to be its much higher tolerance of silt. In the Great Fish River, thomasseti was undoubtedly able to survive droughts, mud-laden floods, high alkalinities and high summer temperatures (Scott, 1974).

The larvae are very easily recognizable, and in addition to the typical frontoclypeal apotome, they have a typical stance with head uptilted, and frequently furred with a growth of aufwuchs. In the Great Fish River, they were also often found heavily encrusted with $CaCO_3$, crystallized out from the water. Imagos emerge from August to March, varying in different parts of the country. In the Summer rainfall regions, the emergence period is extended throughout this time, whereas in the Winter rainfall area (West Cape), the emergence period appears to be shorter (September to December).

As with afra, however, several other species are very similar to thomasseti, particularly C. nubila (Natal, Ethiopia) and C. urema (Kenya, Uganda, Kivu). C. urema may well prove to be a synonym. In order to sort out these problems it will be necessary to breed out the larvae of urema and of nubila. C. falcifera has also been recorded from the West Cape, but to date we have none available for study. It, too, has a distribution ranging from Ethiopia and the Ivory Coast to South Africa. The larva (Statzner, 1984) is certainly thomasseti in type, but so are several other Ivory Coast species. We have many unidentified "thomasseti-type" larvae in our collection, all of which need correlation. Again the question arises: are we dealing with a variable species with many phenotypic expressions, or with a complex of several closely similar sibling species which are not readily morphologically separated?

Conclusions

Both C. thomasseti and C. afra are widespread, eurytopic or generalist species, with individuals able to adapt to a range of environmental conditions. C. maculata, restricted in distribution, is more stenotopic and specialized for an existence in fast-flowing, clear, cold waters. It is possibly a Gondwanaland relict species, of which there are a number in South Africa, particularly the Cape Province. As we have seen, it could well be that with C. afra, we are dealing with a complex of closely related sibling species which are indistinguishable in the adult stage. Kimmins (1960) did notice minor differences in male genitalia, explaining these as variations within widespread species. The occurrence of dark and light pigmented phases in the larvae of C. afra are undoubtedly epigenetically modified variations. It could be that other variations caused by environmental cues actually give rise to the wide array of morphological variations encountered in this species. The wide range of chemical and physical conditions encountered by C. afra and C. thomasseti throughout their distribution in southern Africa are a further indication of the tolerance and plasticity of physiological characters of the species.